



Development of a national animal welfare index

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International conference on pig welfare: **Improving pig welfare – what are the ways forward?**

Copenhagen
Denmark
29th - 30th April 2015



PROCEEDINGS



Ministry of Food, Agriculture
and Fisheries of Denmark





CONTENTS

Welcoming message from the Danish Minister of Food, Agriculture and Fisheries.....	3
Welcome statement from the Commissioner for Health and Food safety.....	4
Animal Welfare in Denmark	5
Programme	10
Short papers from plenary speakers.....	13
Poster abstracts	61
Workshop programmes and abstracts	137
Blank pages for notes.....	164

CONFERENCE ORGANISATION AND ACKNOWLEDGEMENTS

The Danish Centre for Animal Welfare has in cooperation with the Danish Ministry of Food, Agriculture and Fisheries organised the conference.

The organizers wish to thank Aarhus University and University of Copenhagen for their contribution to organising the conference.

WELCOME

DEAR PARTICIPANT,

I am delighted to welcome you to the International Conference on Pig Welfare in Copenhagen! It is truly remarkable that we have been able to gather almost four hundred participants to discuss the ways forward for pig welfare, some joining us from as far away as the state of Iowa and Australia.

I believe the political momentum for improving the welfare of pigs is present, and that now is the time to take advantage of it. But how should we proceed, what are the political options and first and foremost: What are the ways forward?

These are the questions we are gathered here to address. During the next two days, with a program filled to the brim with top academics, experts and political stakeholders from around the world, I expect the debates and work that will take place to lay the first stones in further improving pig welfare in Europe and ultimately in the world.

The Economist has named Denmark “an agricultural superpower” with reference to our substantial and effective pig sector. We produce almost 30 million pigs a year – quite a lot for a small country with only 5,3 million inhabitants.

However, this comes with a great responsibility.

A pig is an intelligent sentient being, and should be treated as such. That is why we have legislation and voluntary agreements in place that seek to secure a high standard of animal welfare in the stables, transports and slaughterhouses. These changes did not appear over night, and they did not always come easy.

A little over a year ago, I gathered all the national stakeholders in the pig sector for a summit on pig welfare where a declaration was signed by both animal rights groups and the pig production sector. This led to an action plan on pig welfare that outlined important issues in our production and set clear goals for improving them.

In many ways, this is what keeps Denmark a world leader on animal welfare. But we can do even better: We are committed to sharing our experiences and learning from others.

This conference is an opportunity for scholars, experts, NGO's and international stakeholders in the field of pig welfare to discuss the strategies on how to move forward on pig welfare - not only for Denmark but for pig production throughout the world. I believe this is an obligation we have, scholars, lobbyists and politicians alike, not only to the animals in our stables but to each other.

I hope you will find the conference and your stay in Copenhagen both valuable and enjoyable.



Many regards,

A handwritten signature in dark ink, appearing to read 'Dan Jørgensen'.

Dan Jørgensen,
Minister of Food, Agriculture and Fisheries

WELCOME

Animal welfare in the European Union: toward full compliance

By the EU Commissioner for Health and Food Safety, Vytenis Andriukaitis

A major milestone for animal welfare was attained with the Treaty of Lisbon in 2009. Indeed, the definition of animals as “sentient beings” is now a stand-alone in the Treaty on the Functioning of the European Union and it represents one of the provisions of general application which affects several important EU policies.

Animal welfare is part of the overall concept of quality and more and more European consumers call for animal friendly products.

The EU Strategy for the protection and welfare of animals 2012 – 2015 is focussed on the enforcement of the EU rules. The holistic approach of the Strategy reinforces the priority given to proper enforcement of the current EU rules to grant fair competition conditions in the internal market.

As regards the state of implementation of group housing of sows across the Union, almost two thirds of Member States are fully compliant while others are making steady progress in order to be fully compliant. In addition to the group housing of sows, work is still on-going on the development of guidelines on the protection of pigs. The guidelines will aim to achieve better implementation of the Directive’s requirements on the use of manipulable materials.

Furthermore the Commission acts as facilitator to encourage the abandoning of the surgical castration of pigs: this action was initiated by main European stakeholders and some Member States. The contribution of the Commission with scientific and technical research in this area is important to ensure that progress is made.

Better education and increasing dissemination of innovative solutions and good practices are essential tools for improving animal welfare. The Commission proposal revising the legislation on official controls includes the establishment of EU reference centres for animal welfare. These centres will make a valuable contribution through better technical knowledge and assistance, strengthening the enforcement of animal welfare standards.

The future of animal welfare for pigs in the European Union is improving and the Commission and I will continue to prioritize animal welfare.

ANIMAL WELFARE IN DENMARK

What are the best ways for defining and assessing animal welfare and how is this reflected in welfare regulations as well as in recent political initiatives? The Danish approach to these issues is briefly described below. An introduction is given to the Danish Pig Welfare Action Plan that was launched in 2014 and to the Danish Centre for Animal Welfare that was established in 2010.

DEFINING ANIMAL WELFARE - THE FIVE FREEDOMS

In order to achieve a basis for assessing the animals' welfare, we have to translate the vision of the good animal life into criteria, the fulfilment (or lack of fulfilment) of which can be measured. One of the most influential attempts to set out such criteria is the Five Freedoms, which were developed by the British Farm Animal Welfare Council (based on the work of the Brambell Committee). The Five Freedoms clearly set out a framework defining what should be checked and measured when assessing animal welfare. However, the measures are worded very broadly and therefore leave it open where to draw the line in determining whether an animal can be said to be offered conditions that give it the five freedoms.

ANIMAL WELFARE LEGISLATION IN DENMARK

The current Danish Act on the protection of animals gives the general basic principles on animal welfare. The Act was adopted by Parliament in 1916 and has been amended several times since, however, the basic principles have not been amended. The Act covers all wild and domesticated animal species, both vertebrates and non-vertebrates. It is mainly a framework-act although it contains a number of specific provisions. The basic principles are contained in paragraphs 1, 2, and 3, section 1 of the Act.

In Denmark there are a number of Acts and Provisions that go beyond EU regulation - for example with respect to loose housing of pregnant sows already from the time of weaning.

PIG WELFARE ACTION PLAN

Recognizing the huge responsibility that comes with a Danish production of approximately 30 million pigs annually, it has been established that there is a need to do more to address welfare problems for pigs. This should be done in a way that balances the need for significant improvements of animal welfare with the interests of the industry and with respect to economic growth and development.

On 13th of March 2014, Dan Jørgensen - Danish Minister of Food, Agriculture and Fisheries - invited representatives from the Danish farming industry, slaughterhouses, animal welfare organizations, consumer organizations, veterinarians and retailers to a 'Pig Summit' focusing on better welfare for pigs. At the summit it was agreed to work for significant animal welfare improvements for pigs - at the same time considering the high reputation of Danish Agriculture and Food Industry as well as future growth possibilities in the food sector.

It was furthermore agreed that conditions in the pig barn should be improved through a joint effort. The main emphasis of this effort will happen in the agricultural industry – however the support from retailers and consumers is also important.

In order to achieve the objectives agreed upon at the Pig Summit, an action plan for better animal welfare for pigs has been launched by the Danish Ministry for Food, Agriculture and Fisheries in June 2014. The action plan comprises a number of initiatives on nine key areas (see Fact Box).

DANISH CENTRE FOR ANIMAL WELFARE

The Danish Centre for Animal Welfare (DCAW) based at the Danish Veterinary and Food Administration was established in 2010 with an overall aim to contribute to the improvement of animal welfare in Denmark.

The main tasks of DCAW are to collate and communicate animal welfare related data and knowledge to relevant stakeholders, such as farmers, politicians, NGO's, veterinarians and the general public. In DCAW, the authorities work together with animal welfare researchers from the University of Copenhagen and Aarhus University in order to initiate and support animal welfare research in order to boost the animal welfare agenda.



DCAW has in cooperation with the Danish Ministry of Food, Agriculture and Fisheries organized the international conference: Improving pig welfare – what are the ways forward?

For more information on DCAW's activities and organisation visit the website: <http://www.foedevarestyrelsen.dk/english/Pages/default.aspx>

DEVELOPING NATIONAL ANIMAL WELFARE INDICES FOR PIGS AND CATTLE

In Denmark, there is a great desire to better assess and monitor changes over time in animal welfare, especially for pigs and cattle. Therefore, a political decision has recently called for a project with the aim of developing animal welfare indices for pigs and cattle at a national level. National indices will form the basis for better decision-making among veterinary authorities, politicians and the agricultural industry in regard to animal welfare. Furthermore, national indices will make it possible to assess the results of different activities that may affect animal welfare – e.g. new legislation or campaigns. The development of indices is carried out in a collaborative project involving The Danish Veterinary and Food Administration, University of Copenhagen and Aarhus University. Aspects of the project will be presented at the conference by Professor Björn Forkman and Professor Hans Houe from University of Copenhagen.



THE FIVE FREEDOMS

(Source: www.fawc.org.uk/freedoms.htm)

1. Freedom from hunger and thirst – by ready access to fresh water and a diet to maintain full health and vigour
2. Freedom from discomfort – by providing an appropriate environment including shelter and a comfortable resting area
3. Freedom from pain, injury or disease – by prevention or rapid diagnosis and treatment
4. Freedom to express normal behaviour – by providing sufficient space, proper facilities and company of the animal's own kind
5. Freedom from fear and distress – by ensuring conditions and treatment which avoid mental suffering

THE DANISH ACT ON THE PROTECTION OF ANIMALS - BASIC PRINCIPLES

“§ 1. Animals shall be treated properly and protected against pain, suffering, fear, permanent injury and substantial inconvenience in the best possible manner”.

“§ 2. Any person, who keeps animals, shall ensure that they are treated with care, including that they are housed and provided with feed, water and attention, regard being made to their physiological, behavioural and health-related needs in accordance with established practice and scientific experience”.

“§ 3, section 1. Premises or areas, in which animals are kept, shall be designed in such a way that the needs of the animals are taken into account, cf. paragraph 2. In this connection it shall be ensured that the animals are given appropriate freedom of movement, also when eating, drinking and resting. Furthermore animals shall be protected against wind and weather in accordance with their needs”.

DANISH CENTRE FOR ANIMAL WELFARE (DCAW)



DCAW aims at contributing towards improving animal welfare in Denmark by:

- Communicating knowledge on animal welfare to relevant stakeholders through:
 - an annual conference - results from initiated research projects along with new developments and findings relevant to animal welfare issues are presented
 - an annual animal welfare report – results from animal welfare inspections and articles on current animal welfare topics
 - DCAW website (www.fvst.dk)
- Comparing animal welfare conditions in Denmark with those of other European countries
- Initiating projects addressing identified problems associated with animal welfare

ACTION PLAN - BETTER ANIMAL WELFARE FOR PIGS

1. Higher survival rates among piglets and sows
2. In the longer term all sows should be housed in loose housing systems
3. Ending castration of piglets
4. Reducing the number of tail docked piglets
5. Strengthened efforts against gastric ulcers
6. Animal welfare to be included in innovation of future pig stable systems.
7. More options and information for consumers
8. More education in animal welfare
9. Pig welfare improvements internationally



DAY 1 PROGRAMME

07:45-08:45	Registration of participants
08.45-09.00	Welcome and Introduction to the Danish Pig Welfare Action Plan Dan Jørgensen, Minister for Food, Agriculture and Fisheries, DK
09.00-09.20	The Welfare Challenges Facing the Pig Sector Peter Stevenson, Chief Policy Advisor of Compassion in World Farming, UK
09.20-10.10	Could Animal Production become a Profession? David Fraser, Professor, University of British Columbia, Canada
10.10-11.00	Coffee break and poster viewing Downstairs Foyer + 2 nd floor foyer
DANISH PIG WELFARE ACTION PLAN	
11.00-11.30	Assessment and Alleviation of Pain in Pig Production Sandra Edwards, Professor, Newcastle University, UK
11.30-12.00	Neonatal Piglet Mortality in Relation to Sow Farrowing Environment Lene Juul Pedersen, Senior Researcher, Aarhus University, DK
12.00-13.00	Lunch
PIG PRODUCTION – A SUSTAINABLE PRODUCTION	
13.00-13.30	Animal Welfare in Organic Pig Production Jan Tind Sørensen, Professor, Aarhus University, DK
13.30-14.00	The Intelligent Pig Barn Anders Ringgaard Kristensen, Professor, University of Copenhagen, DK
14.00-14.10	Introduction to workshops Per Henriksen, CVO, Danish Veterinary and Food Administration, DK
14.10-14.40	Coffee break + relocate to upstairs workshop rooms
14.40-16.40	Workshop sessions
	Workshop 1: Mortality and Welfare in the Farrowing Unit Room: 'Hovedbanen' – 2 nd floor
	Workshop 2: Castration of Piglets Room: 'Kastrup Lufthavn' – 1 st floor
	Workshop 3: Tail Docking of Piglets Room: 'Amager Strandpark' – 1 st floor
	Workshop 4: Promoting Sustainability and Pig Welfare: Is It Possible? Room: 'Kødbyen' – 2 nd floor
	Workshop 5: Market Driven Animal Welfare – The Role for Retailers and Consumers Room: Main auditorium – ground floor
	Workshop 6: Animal Welfare Education and Training – How, For Whom and To What Effect? Room: 'Vesterbro Torv' – 2 nd floor
	Workshop 7: Transport of Pigs and Animal Welfare Room: 'Enghave Plads' – 2 nd floor
16.40-16.55	Relocate to main auditorium on ground floor
16.55-17.00	Introduction to speeches from Ministers and to panel discussion Dan Jørgensen, Minister for Food, Agriculture and Fisheries, DK
17.00-17.10	Towards Sustainable Pig Farming – The Dutch Way. Sharon Dijksma, Minister for Agriculture, NL

17.10-17.20	Minding Animals – Ways to Improve Animal Welfare Christian Schmidt, Federal Minister of Food and Agriculture, DE
17.20-17.30	High Animal Welfare – A Winning Concept for Future Pig Production Sven-Erik Bucht, Minister for Rural Affairs, SE
17.30-17.55	Panel discussion between the Ministers
17.55-18.00	Short statement from the European Commission Representative from the European Commission
18.00-19.00	Happy hour
19.30-	Conference dinner

DAY 2 PROGRAMME

08.30-09.00	Registration of participants
09.00-09.10	Opening of day 2 Per Henriksen, CVO, Danish Veterinary and Food Administration, DK
	ANIMAL WELFARE ASSESSMENT
09.10-09.40	Use of Animal Welfare Indicators Jeremy Marchant-Forde, Research Animal Scientist, USDA-ARS, USA
09.40-10.10	Use of Register Data to Assess Animal Welfare Hans Houe, Professor, University of Copenhagen, DK
10.10-10.40	The Danish Animal Welfare Index Project Björn Forkman, Professor, University of Copenhagen, DK
10.40-11.10	Coffee break and morning snack
	EDUCATION AND MARKET DRIVEN ANIMAL WELFARE
11.10-11.40	Ethical Meat Production and Consumer Responses Athanasios Krystallis Krontalis, Professor, Aarhus University, DK
11.40-12.10	Good Welfare is Good Business Jeremy Cooper, CEO, Freedom Food and Kate Parkes, Senior Scientific Officer, RSPCA, UK
12.10-12.40	The Effects of Stockperson Education and Training on Farm Animal Welfare Paul Hemsforth, Professor, University of Melbourne, Australia
12.40-13.30	Panel discussion Peter Stevenson, Chief Policy Advisor for Compassion in World Farming, UK Dan Jørgensen, Minister for Food Agriculture and Fisheries Peter Sandøe, Professor, University of Copenhagen, DK Claus Fertin, Head of Danish Pig Research Centre, DK Britta Riis, Eurogroup for Animals, DK
13.30-13.45	Closing remarks for conference Dan Jørgensen, Minister for Food, Agriculture and Fisheries, DK
13.45-14.45	Lunch



SHORT PAPERS FROM
PLENARY
SPEAKERS



Peter Stevenson studied economics and law at Trinity College, Cambridge. He is the Chief Policy Advisor of Compassion in World Farming. He has written comprehensive legal analyses of EU legislation on farm animals and of the impact of the WTO rules on animal welfare. Peter is lead author of the recent study by the FAO reviewing animal welfare legislation in the beef, pork and poultry industries. He has written well-received reports on the economics of livestock production and on the detrimental impact of industrial farming on the resources – land, soil, water, biodiversity – on which our future ability to feed ourselves depends.

THE WELFARE CHALLENGES FACING THE PIG SECTOR

Peter Stevenson, Compassion in World Farming

SUMMARY

Pig welfare reforms that are needed include ending surgical castration and farrowing crates as well as compliance with EU legislation that requires the provision of enrichment and prohibits routine tail docking. Improved welfare can sometimes produce economic benefits. In other cases it entails increased costs but consumers are increasingly willing to pay for better welfare. Substantial CAP funds should be used to help restructure the pig sector. Tax breaks could help reduce the costs of high welfare for farmers and consumers. We need a new model of food and farming that promotes healthy diets, good animal welfare and protects natural resources.

The pig sector is now largely compliant with the EU ban on sow stalls. This is welcome though some Member States have yet to achieve full compliance. However, a number of serious problems remain. I recognise the pig sector is under continuing pressure to reduce costs which can make it difficult to improve welfare. But better welfare is essential.

CASTRATION

Most male pigs in the EU continue to be castrated. The European Declaration on alternatives to surgical castration of pigs aims to end

surgical castration by 2018. Progress has been slow.

Some Member States have avoided castration for many years. Castration is rare in Ireland and the UK and most pigs are not castrated in Spain and Portugal. However, only two Member States have made substantial progress since the Declaration was signed. 60% and 39% of Dutch and Belgian male pigs respectively are no longer castrated.

The pig sector must commit much greater energy to ending surgical castration. A good approach is immunocastration. This is widely used in Belgium so it should be possible to gain consumer acceptance elsewhere.

Alternatively, entire males can be reared. Boar taint and aggression in entire males can be reduced by selective breeding, modified feed composition, reduced stress, and maintaining clean floors and animals.¹ Where surgical castration is performed, prolonged analgesia and anaesthesia must be used though none of the methods currently available are really satisfactory.

SENTIENT BEINGS

The EU Treaty recognises animals as “sentient

beings". One aspect of sentience was illuminated by Lyall Watson in **The Whole Hog**:

"I know of no other animals that are more consistently curious, more willing to explore new experiences, more ready to meet the world with open-mouthed enthusiasm. Pigs are incurable optimists and get a big kick out of just being".

Yet most EU pigs are reared in barren conditions in which they are unable to engage in their natural behaviours of rooting, foraging and investigating their surroundings. Kept indoors throughout their lives, they never experience fresh air, daylight or the warmth of the sun.

ENRICHMENT MATERIALS AND TAIL DOCKING

The Pig's Directive requires farmers to provide effective enrichment. It states that pigs "must have permanent access to a sufficient quantity of material to enable proper investigation and manipulation activities, such as straw, hay, wood, sawdust, mushroom compost, peat ...".

Farmers may use a material other than one of those specified but it must be as effective as those listed in fulfilling the objective of the legislation which is that pigs must be able to engage in "proper investigation and manipulation activities".

The European Food Safety Authority (EFSA) has concluded that enrichment materials should be complex, changeable and destructible² and that chains, plastic chewing sticks and balls are not effective as enrichment.³

Most farmers provide no enrichment at all or just metal chains even though the European Commission has stressed that since chains "are not sufficient to provide for the manipulatory need of pigs, they may be used as *supplement* to destructible and rooting materials but not as a *substitute* for them".⁴

The Directive also prohibits routine tail docking. It does not prohibit all docking but provides: "Before carrying out [tail docking], other measures shall be taken to prevent tail biting

... For this reason *inadequate environmental conditions or management systems must be changed.*"

This means that farmers may only lawfully tail dock if they have first tried to prevent tail biting by "other measures" and in particular have changed "inadequate environmental conditions or management systems" but nonetheless still have a tail biting problem.

Scientific research helps us to understand which conditions are "inadequate" as it has identified the factors that are most likely to cause tail biting. EFSA has concluded that "the largest risk for being tail bitten is the lack of appropriate enrichment".⁵

If there are no enrichment materials or only chains, toys or plastic objects, the farmer has failed to change "inadequate environmental conditions" and so cannot tail dock.

A Technical Report prepared for EFSA stresses: "An intact curly tail may well be the single most important animal-based welfare indicator for ... pigs In addition, it stands for high-quality management and respect for the integrity of the pig."

Farmers who get their pigs through to slaughter age without either tail biting or docking will have run a very good system.

The EU legislation that requires the provision of enrichment and prohibits routine tail docking has been in force since 2003. Yet it is ignored by the vast majority of farmers. The pig sector must stop behaving as if it is above the law.

Member States must now enforce the law. The *EUWeNet project* has produced an excellent training tool to assist enforcement officials in understanding these provisions.⁶ The Member States should use this tool which is available in several languages.

SENTIENT BEINGS REVISITED

Another glimpse of what sentience might entail was provided by St Basil of Caesaria in the Fourth Century:

“May we realize that they live not for us alone, but for themselves and for Thee and that they love the sweetness of life even as we, and serve Thee better in their place than we in ours”.

MANY SOWS STILL SPEND OVER 20 WEEKS OF THE YEAR IN CRATES SO NARROW THAT THEY CANNOT TURN ROUND

The EU ban on sow stalls allows them to be used for the first four weeks of pregnancy. In addition the ban does not extend to farrowing crates. Sows are placed in farrowing crates 3-7 days before giving birth and are kept there until the piglets are weaned at 21-28 days of age. On average sows produce 2.3 litters per year. Accordingly, despite the sow stall ban, many EU sows continue to be confined in stalls/crates for over 20 weeks each year.

Farmers should stop using sow stalls altogether. Farrowing crates should be rapidly replaced by free farrowing systems. A number of such systems are available and research shows that piglet mortalities in loose farrowing systems can as low as or lower than in crates.^{7 8}

EXCESSIVE LITTER SIZE

The breeding of sows for large litters results in high levels of mortality before birth and among piglets born alive. The latter is due to low birth weights which are also associated with a variety of negative long-term effects on piglets, such as increased reactivity to stress throughout the pig's lifetime.⁹ Large litters can result in intense teat competition which can be painful for the sow and lead to some piglets failing to gain sufficient milk.¹⁰ The breeding of sows for increasing litter size should be ended.

THE WAY FORWARD

We need to challenge the assumption that better welfare will always be an economic burden. The designer of the 360° farrowing pen reports that because this system is less stressful for sows, they eat more leading to the piglets being up to 25% heavier at weaning.¹¹ The average benefit of raising uncastrated pigs is around €5 per pig due to better feed conversion.¹² Beyond a certain point increasing litter

size can be economically disadvantageous due to the increased costs of sow care and the poorer quality of some piglets.¹³

In some cases improved welfare will entail higher costs. However, good animal welfare can be a marketing advantage as there is growing interest in food quality with consumers viewing good standards of animal welfare – along with health, provenance, taste and wider sustainability attributes – as an important component of food quality.

Farmers who rear pigs outdoors or to high indoor welfare standards under an assurance scheme may find that consumers are willing to pay a price premium which not only covers the extra costs but provides increased profits.¹⁴ Some retailers will pay more for high welfare pigmeat e.g. the German initiative Tierwohl.

Compassion in World Farming engages positively with food businesses providing advice and technical support. Its Good Pig Award celebrates farms and companies with high welfare standards.

If consumers are to fully play their part in driving animal welfare improvements they need to be better informed about today's livestock production methods and their implications for animal welfare. Governments and industry need to be more open about the nature of modern intensive production. This could lead to a greater proportion of consumers being prepared to pay more for high welfare food. Also, mandatory labelling of meat as to farming method should be introduced; this would empower consumers to make informed choices. As is already the case for eggs, meat from intensively farmed animals should be labelled as such.

Government too must play a part in helping us move to higher welfare. Substantial CAP funds should be used to help restructure the pig sector e.g. by supporting investments in free farrowing systems and contributing to the cost of providing enrichment materials for a transitional period.

Tax breaks could reduce the cost of high welfare farming. Farmers' tax liabilities could be reduced by providing generous capital allowances for investments in high welfare farming. Consumer costs could be lowered by placing the minimum VAT rate on high welfare food.

A report by the German Scientific Advisory Board stresses that the livestock sector has become socially unacceptable due to its adverse impact on animal welfare and the environment.¹⁵ It concludes: "the current housing conditions of the majority of farm animals are unsustainable". The European Commission points out that overconsumption of animal protein can lead to obesity, diabetes, heart diseases and certain cancers.¹⁶

We need a new model of food and farming. This should restore and enhance the natural resources – water, soil, biodiversity - on which our ability to feed ourselves depends. It should promote healthy diets and good animal welfare. We should unlock farmers from the treadmill of having to produce ever more at ever lower costs. Farmers should be able to earn a decent living from producing high quality food.

EU farmers must not be undermined by cheap imports from third countries produced to lower animal welfare standards. The EU should require imported animal products to come from animals reared to welfare standards equivalent to our own. Recent developments in WTO case law suggest that this is possible provided that there is no element of discrimination against imports.¹⁷

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17 Paper available from author peter.stevenson@ciwf.org



David Fraser has maintained a strong interest in animals and animal welfare throughout his 43 years of teaching and research spanning farm, companion, laboratory and wild animals. He is currently Professor in the internationally respected Animal Welfare Program of the University of British Columbia in Vancouver. He has served as a scientific advisor to many organizations including the the World Organisation for Animal Health (Paris), the Food and Agriculture Organization of the United Nations (Rome) and the Food Marketing Institute (Washington). He is the author of "Understanding Animal Welfare: The Science in its Cultural Context" (Wiley-Blackwell, 2008), and is in high demand as a lecturer. In 2005 he was appointed Member of the Order of Canada for his contributions to animal welfare science.

COULD ANIMAL PRODUCTION BECOME A PROFESSION?

David Fraser, Animal Welfare Program, University of British Columbia

ABSTRACT

In the industrialized countries, intensive animal production is widely perceived by the public as "industrial", and attempts to protect animal welfare have followed the model of factory reforms from earlier generations, mostly through standards and regulations for the physical environment. However, animal welfare is strongly influenced by the quality of animal care which, in turn, depends on the skill, knowledge and attentiveness of animal producers and their staff. Re-shaping animal production to be more like a profession, and less like an industry, could be a powerful way to improve animal welfare and create public trust in producers.

INTRODUCTION

During the Industrial Revolution, large parts of Europe were transformed from an agrarian society to an industrial society, and the change triggered a profound debate. On one side were traditional agrarian values combined with the values of the Romantic Movement which developed partly as a reaction to industrialization. This viewpoint:

- valued a simple, basic life,
- saw nature as an ideal state that we should try to return to,
- valued emotion ahead of the rationality that created industrial machinery,

- valued the freedom of the individual rather than the regimentation of the factories,
- and looked back to a Golden Age in the past when people lived simpler, better lives that were closer to nature.

The supporters of the Industrial Revolution had a very different, pro-technology, pro-industrial world-view that involved two concepts that were fairly new to Western thought. One was "productivity" which was seen as beneficial because it increased the supply of goods available to improve the quality of human life. A second was "progress" – the idea that all change occurs in the direction of improvement. This pro-industrial world-view:

- valued a life improved through science and technology,
- saw nature as an imperfect state that we should control and improve,
- valued rationality rather than irrational emotion,
- valued productivity more than the freedom of the individual,
- and looked forward to a Golden Age in the future when progress through science and technology will lead to a better life for all.

The conflict between those world-views remains an important part of our culture today,

and helps to explain many of the continuing debates in society: over country living versus city living, over scientific medicine versus alternative medicine, over production agriculture versus organic agriculture. And perhaps inevitably, the different world-views have given rise to some different ideas about animal welfare:

- For many people, following the Romantics and Agrarians, a good life for animals must be a natural life, with freedom, fresh air, and the ability to behave in natural ways.
- For many others, following the Industrial world-view, a good life for animals must be a healthy life, free from disease and injury and with good growth, reproduction and productivity.
- And for others, reflecting the emphasis on emotion that we see in the Romantics, a good life for animals must be a happy life, with comfort and contentment, low levels of stress and good management of pain.

These different views of animals are deeply embedded in our culture and all need to be taken into account if standards and practices are to be widely perceived as protecting animal welfare.

In addition to the broad debate about agrarian versus industrial life, the Industrial Revolution also triggered a reform movement that tried to protect the welfare of workers, mostly by creating a wide range of regulations to improve health and safety in factories. These focused mostly on aspects of the physical environment including space, ventilation and safety features, as well as limiting exposure to the environment by restricting hours of work.

THE INTENSIFICATION OF ANIMAL PRODUCTION

Animal production has intensified over the past half century for many reasons. These include:

- policies to increase food production and reduce rural poverty,
- a shortage of farm labour during a time of urbanization,
- the availability of new technology that made intensive production possible.

To many producers, the changes were seen as a beneficial form of modernization.

To the public, however, intensification was largely seen as “industrialization” and it triggered much the same concerns that occurred during the Industrial Revolution. One concern was the loss of traditional agrarian life, and especially in North America the claim that intensification involves “factory farms” replacing “family farms” has proven a powerful argument with the public.

The second concern focused on “welfare” – but in this case the welfare of the animals rather than factory workers. And much as had occurred during the Industrial Revolution, a common response has been to regulate the animals’ environment, especially through laws and European Union Directives. These cover space allowance, air quality, and freedom of movement, plus maximum exposure time, for example by limiting the length of time that animals can be in close confinement.

How well are the current reforms working to improve animal welfare?

But how well are these reforms working to improve animal welfare?

In some cases, probably well. For example, when ammonia levels rise above 25 parts per million in the air, many animals develop health problems. Therefore, standards limiting ammonia levels seem likely to be of real benefit for animal welfare.

But when we look at very basic welfare outcomes across farms all using the same type of housing, we typically see wide variation as illustrated by three examples.

- A high rate of piglet mortality must be seen as a major animal welfare issue because most piglets die from some combination of starvation, chilling and injuries. A study of 39 farms in Norway, all using loose housing for sows at farrowing, found that the percentage of piglets that died before weaning ranged from 5% on the best farm to 24% on the worst. A study

of 30 farms in Canada with sows in farrowing crates found that piglet death rate varied from 10% on the best farm to 32% on the worst. And a study of organic farms in Europe reported piglet deaths ranging from 0 to 50% on 83 farms, all presumably conforming to organic standards for loose housing.

- In the case of dairy cows, lameness and leg lesions are major causes of pain and a common reason for culling, and these problems vary enormously from one farm to another. For example, a study of 121 dairy farms, all with free-stall housing, found that the percentage of lame cows ranged from 5% on the best farm to 85% on the worst, and cows with leg lesions ranged from 0% to 100%.

- Broiler chickens have several basic welfare indicators that have been studied on a range of farms. A study in the United Kingdom, for example, monitored 114 flocks all using open barns with litter floors. The number of birds that died before being sent for slaughter ranged from 1.4% of birds in the best company to 14% in the worst, and the percentage of lame birds ranged from 0% in the best company to 90% in the worst.

Results such as these show that very different welfare outcomes occur in the same type of physical environment. Why? Presumably this is because welfare outcomes depend strongly on the quality of care that the animals receive, and this, in turn, depends on the knowledge, skill and attentiveness of the producer and staff. For example, the risk of piglets dying from starvation, chilling or injury can be reduced by:

- providing a warm, draft-free environment for newborns,
- timely fostering of piglets from large litters,
- assisting weak piglets to obtain colostrum,
- skillful assistance of sows in cases of prolonged parturition,
- good hygiene to prevent mastitis in the sows, because many piglet deaths occur in litters where mastitis reduces milk production.

Here we see an important difference between industrial manufacturing and intensive animal production. When factory workers spend only a part of their days in factories, regulating the

environment is a plausible way to deal with the welfare challenges. But when intensively raised animals spend their entire lives under human control, good animal welfare relies not only on features of the physical environment but also (and perhaps mostly) on the skill, knowledge and commitment of the people involved. Thus, if we want to improve animal welfare – along with food safety, environmental protection and other socially important goals – we need to foster and reward a high level of skill, knowledge and dedication by the people.

PROFESSIONAL ANIMAL PRODUCTION

How could this be achieved? Fortunately, agrarian production and industrial production are not the only occupational models that can be applied to raising animals. The “professions” provide a third type of occupation which has its most sophisticated form in health care.

By most accounts professions include three elements:

- The main outcome is service, usually to clients or the public.
- Participation requires competence, typically demonstrated to peers, and
- Ethical acceptability is maintained by adhering to ethical norms of society usually through some form of self-regulation within the profession.

Given these three criteria, could animal producers re-shape their occupation to be more like a profession and less like an industry?

First, are animal producers providing a service or just trying to sell products? Fifty years ago, with the Green Revolution, grain became so cheap and abundant that there was an explosion of grain-based animal production, and we saw, for example, the pork sector competing with the beef sector for a greater share of the market. In that respect, animal production was acting more like an industry than a profession. But we are entering a time when the demand for food is expected to exceed current production because of increasing world population, climate change and other factors. Thus, the need for food may well make food production

look less like a group of industries competing to sell their products, and more like a profession providing an important service.

A second feature of professions is competence: people cannot just decide to be doctors – they have to demonstrate their ability. Could this be applied to animal producers? Fifty years ago, when animal production was in the hands of millions of small-scale, mixed farmers, this would have been inconceivable. Today, however, pig production is a very specialized occupation where it is reasonable to expect a high level of specific skill and knowledge. Moreover, the past 10-20 years have seen a growing trend for certification of farms according to standards for animal welfare, food safety and other issues. If this certification process were managed by producers and based on achieving good performance rather than simply using certain types of environments, this would move animal production much closer to a professional model.

Third, could animal producers develop a self-regulatory system to show that they are adhering to the ethical expectations of society? Here again, the growing trend toward standards and certification are a move in that direction, but the standards would need to take public expectations into account. As we saw above, people have different views of animal welfare ranging from physical health to natural living conditions to freedom from pain and distress. Thus, to meet the expectations of society, producers would need active engagement with the public to negotiate widely accepted standards.

In all three of the above respects, animal production is not currently functioning as a profession, but changes have occurred which make a professional model look more feasible than ever before. Shifting animal production toward a professional model would be a long-term project, but it seems a more promising way to improve animal welfare than the current approach of regulating the physical environment. And in time I believe it would also help maintain public trust in animal producers.

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ASSESSMENT AND ALLEVIATION OF PAIN IN PIG PRODUCTION

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SUMMARY

In the process of pigmeat production, animals can experience pain which compromises their welfare. This sometimes arises from procedures carried out deliberately for management purposes. These require an ethical justification underpinned by scientific assessment of the intensity and duration of pain and distress associated with each course of action, and the potential for pain alleviation by appropriate anaesthesia and analgesia. In other cases, pain arises from spontaneous health disorders. Whilst risk factors and remedial measures are often known, better methods are required for the on-farm assessment of associated pain and the provision of analgesia when this occurs.

INTRODUCTION

"Freedom from pain, injury and disease" makes a fundamental contribution to good animal welfare, and is enshrined in the "Five Freedoms" used widely as a welfare framework. However, in the process of breeding and rearing pigs for meat production, some animals can experience pain which compromises their welfare. In some cases, this pain results directly from procedures carried out as a result of management decisions. Widespread examples of these include the castration of male pigs to reduce the risk of boar taint in the meat, the

docking of piglets' tails to reduce the risk of injurious tail biting in later life, the reduction of canine teeth in neonates to reduce facial damage from sibling competition, the nose-ringing of outdoor sows to reduce pasture destruction, and the ear tagging, tattooing and slap marking of animals for identification purposes. In other cases, the occurrence of pain is not directly attributable to human intervention, but arises from health disorders developed spontaneously by the animals. These include both acute injuries and infections, and more chronic conditions like osteochondrosis, pneumonia and gastric ulcers. The pain associated with such conditions is still poorly understood, and often relies on human analogy. In this paper, the challenges of understanding, practical assessment and alleviation of pain are discussed with reference to three different examples of pain-producing situations. Each of these highlights different issues which must be addressed by scientific research and ethical debate.

CASTRATION

Castration of male piglets is an example of a pain-causing procedure carried out primarily for human benefit. Whilst it has been suggested that animal welfare benefits may also arise, through reduction in aggression and undesirable sexual behaviours as animals reach puberty,

it has been shown in experimental studies and large scale practice that intact males can be reared without major welfare problems when management is good. The main reason for castration is to avoid the risk of undesirable odour and flavour in the meat from compounds associated with male sexual development (the so-called “boar taint”), which markedly reduces the value of the carcass. The justification for the procedure can thus be considered as largely for human economic benefit. Ethical considerations therefore demand that the need for the practice should be questioned and, if it is considered necessary, that methods to prevent or alleviate any associated pain should be sought.

Castration of male animals is widespread throughout the farming industry and accepted as a part of normal commercial practice. Historically it has been carried out on the young animal without anaesthesia or analgesia and, in the case of the pig, by a surgical procedure as necessitated by the anatomy of the testes in this species. There is no doubt that this procedure causes pain – many scientific studies have shown through measurement of physiological and behavioural responses that the pain is intense during the surgery itself, and that some degree of discomfort persists for several days (von Borell et al., 2009).

Given this knowledge, the necessity for the procedure is a topic of current debate. Some countries (UK, Ireland) have largely abolished the practice and other countries are moving in this direction (Backus et al., 2014). This has been stimulated by the 2010 European declaration on alternatives to surgical castration of pigs, a voluntary agreement between stakeholders which states that surgical castration of pigs should be abandoned by 1 January 2018. Whilst progress towards achieving this goal has been made through genetic selection and nutritional interventions to reduce boar taint, and through development of rapid methods for taint detection and on-line carcass sorting, there is uncertainty about how soon these can deliver an acceptable system for entire male production. There are also particular production systems for specialised products, e.g. the

heavy pigs for Italian ham production and traditional breeds in organic and silvo-pastoral rearing systems, where use of entire males may still be infeasible. As an interim measure in many countries, and a possible longer term solution in specialist systems, the continuation of surgical castration with prolonged analgesia and/or anaesthesia is being implemented. Whilst injectable analgesia is simpler to apply, and thus the preferred practical option in most countries at the present time, scientific evidence suggests that it is unable to reliably abolish the acute pain experienced during surgery. In several countries, general anaesthesia is, or will soon become, a legal requirement for continuation of surgical castration but the difficulty and cost of this approach make others doubtful about application. The alternative approach of immunological castration is now technically feasible, and implemented in some countries, but gives rise to significant consumer and retailer concerns. Even if these can be overcome, the ethical issue of animal integrity still remains a barrier to any approach except entire male production.

TAIL DOCKING

Tail docking is also a deliberate management procedure but, unlike castration, its justification is argued on the basis of a cost/benefit balance for the animal itself. It is carried out on the young piglet to reduce the risk of receiving injury from tail biting in later life, which is unquestionably a serious welfare problem. Tail docking also differs from castration in the degree of pain apparently associated with the procedure, with many farmers believing this to be negligible on the basis of the piglet reactions that they observe. Whilst more detailed scientific study suggests that acute pain does indeed occur, measurements of stress physiology have sometimes shown effects no greater than distress from handling. However, the possibility of longer term pain from neuromas which develop in the damaged nerves has also been raised and much uncertainty still exists about this (Edwards and Bennett, 2014).

A true ethical justification of tail docking using risk assessment methodology requires

the quantification of both “exposure assessment” (the number of animals involved and risk of harm) and “hazard characterisation” (the degree of pain and distress) associated with early tail docking or the tail biting consequences of failing to do so. Objective information on this is currently being gathered in the EU FareWellDock project (www.farewelldock.eu). Multidisciplinary approaches to assessment of the immediate and longer term pain associated with tail resection in early or later life include behavioural response and facial expression (Lonardi et al., 2013), changes in tail thermal characteristics and sensitivity to mechanical pressure (di Giminiani et al., 2014), structure and function of the nerves after damage and healing (Carr et al., 2015), and molecular markers in the spinal cord and brain of chronic pain and anxiety (Oberst et al., 2015).

If it can be demonstrated that long term pain does not occur, and that any acute and medium term pain can be alleviated by appropriate use of anaesthesia and analgesia, then the welfare implications of the procedure for the animal itself might be minimal and justifiable to reduce risk of the far greater harm of being tail bitten. However, this does not remove the ethical argument for respecting the integrity of animals. Some countries have already abolished tail docking and, whilst the prevalence of tail biting is higher than in docked animals, risk can be minimised by appropriate housing and management. The risk factors for tail biting have been widely studied and tools for risk evaluation and risk reduction now exist (Taylor et al., 2012). However, even with systems deemed to be of low risk, significant tail biting outbreaks can still occur and, in the absence of any reliable method to control their severity once started, many farmers are reluctant to accept such risk. Looking to the future, genetic selection strategies and improvement in enrichment provision offer further risk reduction potential, whilst recent work on the neuroendocrine basis of tail biting may lead to pharmacological control products which could make this reduced risk acceptable in commercial practice.

GASTRIC ULCERS

Whilst greatest societal and scientific attention has been focussed on the pain associated with deliberate management procedures, from the perspective of the animals these may not be the most important sources of pain-induced welfare compromise. The pain associated with procedures is primarily acute and predictable in time, and therefore amenable to planned pain control interventions. This contrasts with the possibility for both acute and chronic pain associated with unpredictable, and possibly undetected, health conditions. Whilst the pain associated with lameness arising from trauma, infection or degenerative joint disease is now starting to receive more scientific attention, the potential for pain associated with other endemic conditions such as pneumonia and gastric ulcers is still relatively neglected.

Oesophago-gastric ulcers have been shown in a number of surveys to be widespread in both growing pigs and sows. They are characterised by erosion and ulceration of the lining of the stomach. As they become more severe, intermittent bleeding may take place leading to anaemia and, in extreme cases, massive haemorrhage and death (Friendship, 2006). As many as 60-80% of growing pigs can show some degree of alteration or erosion of the stomach lining, and 5-10% have more serious ulceration. In sows the problem seems even greater, with 25% or more of animals showing ulceration. The extent to which these ulcers cause pain to affected animals in relation to their degree of severity is unknown, although only animals with more severe ulcers show inappetance and loss of condition. In humans, the condition is known to be acutely painful, and the similarity in anatomy might suggest this to also be the case in pigs. If so, the high prevalence of the condition constitutes a serious welfare problem.

In humans, bacterial infection with *Helicobacter* is the main cause of gastric ulcers, but infection seems to be a less important causal factor in pigs. It has been known for many years that feed-related factors are the primary cause, with particle size of the diet as the most important.

Finely ground diets, particularly when pelleted, significantly increase severity of ulceration, as do diets with high wheat content. Other dietary factors reported as being associated with increased ulceration have included low protein or low fibre diets, deficiencies in vitamin E, selenium or zinc, and high levels of iron or calcium. Housing conditions can also affect ulcer prevalence and severity, with animals housed in straw-based systems having fewer problems. The extent to which this relates to dietary effects of increased fibre ingestion or to other stress-related aspects of the housing conditions is still unclear, since increasing dietary fibre has sometimes, but not always, reduced ulceration. Social stressors such as mixing and high stocking density, as well as concurrent diseases, can also increase ulceration. It has been suggested that these effects may be mediated through increased irregularity of feeding patterns, another known risk factor and one to which dry sows will be particularly subject, but the mechanistic basis of effects is still poorly understood and genetic differences are also known to exist. Since ulcers can develop in a relatively short period of time, and be exacerbated by transport stress, it is not always straightforward to link abattoir data back to farm practice. Furthermore, since no reliable diagnostics have been validated in live animals, it is difficult to assess the time course of ulcer development and current degree of severity in order to evaluate the extent of any associated pain and address remediation.

CONCLUSIONS

The occurrence of pain in pig production compromises animal welfare and must be actively addressed. Where such pain arises from deliberate management decisions, an ethical justification needs to be underpinned by objective scientific assessment of the intensity and duration of pain and distress associated with each course of action. This assessment can be problematic, as our understanding of the subjective experience of pain in animals is still lacking, and multidisciplinary assessment methodologies need to be employed. The assessment of chronic pain is particularly challenging, making it difficult to quantify for endemic health

disorders which may have widespread prevalence. Whilst the principal goal must be to remove the sources of pain through modification of production practice and reduction in known risk factors, this will not always be completely effective. A reliable method for on-farm pain assessment is then an essential prerequisite for effective alleviation by appropriate anaesthesia and analgesia, and is a pressing subject for research.

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NEONATAL PIGLET MORTALITY IN RELATION TO SOW FARROWING ENVIRONMENT

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SUMMARY

Use of farrowing crates has been associated with a number of negative welfare consequences for sows and piglets, among others lack of space to accommodate the litter size of high prolific sows. Current knowledge indicates that loose housing improves behaviour and physiology of potential benefit for survival and growth of the piglets. However, concerns may be raised about the feasibility of the currently used high prolific genotype particularly for less intensive sow farrowing housing.

DEVELOPMENT IN LITTER SIZE AND NEONATAL PIGLET MORTALITY

The litter size of Danish sows has, due to a successful genetic selection, increased continuously throughout the last 20 years from 12 to more than 17 total born piglets per litter. A side effect has been a simultaneous increase in piglet mortality from approximately 2 to 4 piglets per litter. A similar trend is seen in other countries where breeding for increased litter size is practiced. However, nowhere else than Denmark, the selection has been taken to an extent where the total number of born piglets is now averaging more than 17 (and still in-

creasing), which is beyond what one sow can bring up herself.

The major consequences of the large litter size are increased duration of farrowing, reduction in the average birth weight, reduced colostrum per piglet (Devillers et al., 2007) and lack of teats for all live born piglets (reviewed by Rutherford et al., 2013). In addition, lack of space in the farrowing crate limits the free access to the sow's udder and access for piglets to rest on a comfortable and warm surface away from the sow.

With sows giving birth to an average of 15.4 live born piglets and 13.3 piglets weaned per litter in 2013, it takes a high degree of management input. An increasing number of farms are practising birth surveillance during days where a high number of sows are expected to farrow. Extra personnel are used to assist sows during difficult farrowings and to assure sufficient heat and access to colostrum for small and less viable piglets. To make sure that all piglets get colostrum, split nursing at birth is practiced. The first 10 born piglets are locked into the creep area after having had some co-

lostrum, while the last born piglets are suckling the udder. In order to assure a productive teat for all piglets, additional nursing sows are used. A nurse sow is a newly weaned sow which nurses either a new born litter or a litter from around 5-10 d of age. In average, 15 % of weaned sows are used as nurse sows after having nursed their own litter for 1-3 wks. Such procedures affect welfare of the nurse sows as well as of the litters involved.

SOW FARROWING HOUSING AND NEONATAL PIGLET MORTALITY

Since the late seventies, the farrowing crate became the most commonly used farrowing system worldwide. The farrowing crate saved space and allowed easy manure handling through slatted floor behind the sow. Based on production experiments in commercial herds, the farrowing crate seemed not to increase mortality rate and was thus found economically competitive with the traditional pen system in Denmark (Pedersen and Ingvarsen, 1981). A farrowing crate consists of a pen either with fully slatted floor or partly slatted floor. Within the pen, bars have been set up to prevent the sow from turning around and to control lying down movements. The median size of the Danish farrowing crates was, according to measurements performed on 84 Danish farms, 3.95 m². The median length of the bars crating the sows, measured from the trough, was 198 cm, while the median width at the front and rear part of the sow was 57 cm and 64 cm, respectively (Pedersen et al., 2010). These measurements indicate that the size of the crate is not sufficient to allow undisturbed lying and getting up movements for a normally sized Danish sow, and not sufficient even to accommodate the physical dimensions of some of the larger sows. In addition, crating has been associated with a number of other welfare problems such as inability to perform nest building behaviour, to thermoregulate and to divide the space into a well-defined resting/nesting area, eating area and defecation area. Suppressed nest building and disturbed hormonal secretion related to the birth process and lactation have been observed in crated sows and may potentially disturb the farrowing progress, survival

and growth of the neonatal piglets (reviewed by Algiers and Uvnas-Moberg, 2007).

Due to public concern about animal welfare there is a growing pressure on the pig industry to change the crate system to a system where sows are kept loose. In Sweden, Norway and Switzerland, the farrowing crate has been banned. The pig industry is concerned about increased piglet mortality and increased cost due to space and work load if the crate system will be banned.

To assure high survival of neonatal piglets in a farrowing pen for loose housed sows, pens must be well designed (Baxter et al., 2011). This includes a pen designed to meet the needs of sows and piglets during farrowing and lactation and in addition assuring good hygiene and easy access and overview for the caretaker. The following principles are among the most important (reviewed by Pedersen et al., 2013a):

- Loose housing of sows during the entire reproductive cycle as this reduces stress during parturition, thereby decreasing the risk of a difficult farrowing.
- Space should be provided according to the size of sow and litter.
- Provision of heat such as plenty of straw or floor heating at the birth site and/or increased room temperature around farrowing up to 25 °C to reduce hypothermia of the piglets.
- Establishment of a dunging area using open equipment to neighbouring pens and slatted floor to assure good hygiene combined with a nesting area with solid floor and closed walls to neighbouring pens to attract sows to nest build and farrow away from the colder slatted floor.
- Provision of plenty of straw or other substrate to meet the sows' motivation to nest build and further enhance a zone division helping piglets to dry up and stay warm and to reduce skin abrasions and heel/sole erosion of piglets.
- Establishment of walls with build-in piglet escape zones in the nesting area to support sows lying down and further strengthen zone division.

- To reduce activity in the nest area, feed and water should be placed outside the nest at one side of the slatted floor area, while allowing sufficient space (more than a sow's length) for the sow to turn opposite to defecate.
- Establishment of a creep area of at least 1.1 m² for the piglets with additional heating turned on after the heating device at the birth site is turned off.

PIGLET MORTALITY IN PENS FOR LOOSE HOUSED SOWS

There is good evidence to suggest that loose housing has many advantages that potentially can improve not only welfare but also productivity and survival of sows and piglets. Sufficient nesting material given in a loose housing system allows the sow to perform a more complete repertoire of nest building behaviour. This shortens the duration of farrowing and affects hormones responsible for lactation and good maternal behaviour (Oliviero et al., 2010; Yun et al., 2014; Yun et al., 2015). A prolonged farrowing is a risk factor for MMA, and thus crating may increase the risk of MMA. Access to a large quantity of straw during nesting and post farrowing has also been shown to reduce the development of skin abrasions and heel/sole erosion of piglets and to increase their growth rate (Westin et al., 2014). In addition, when sows have space to move around they show protective behaviour during lying down which may prevent crushing of piglets (reviewed by Damm et al., 2005).

Loose housing enables, to a higher extent than crates, establishment of a thermally comfortable birth site (littered or heated concrete flooring) which reduces mortality (Malmkvist et al., 2006). Loose housed sows may even be better to avoid heat stress since they can thermoregulate using different postures and thermal zones (slatted and concrete floor) (Malmkvist et al., 2012). Therefore, room temperature can be temporarily increased around farrowing in a batch farrowing system for loose housed sows to further reduce the risk of piglet hypothermia (Pedersen et al., 2013b), but without compromising sow welfare.

The majority of studies performed in countries where loose housing systems are used in larger scales on commercial farms show that neonatal piglet mortality of loose housed and crated sows is at the same level (e.g. KilBride et al., 2012; Weber et al., 2007). However, mortality rates have been collected on three Danish farms that recently introduced farrowing pens for loose housed sows on part of their farm (Hales et al., 2014). This study showed that mortality rate of the loose housed sows was higher than in crated sows, but to different degrees on the three farms ranging between an increase of 2 to 8 %-unit. The degree of experience of both caretaker and the sows with the loose housing system may be one important factor for the divergence of the results. However, also the above-mentioned negative implications of high prolificacy such as increased need for extra care of low birth weight, assistance during prolonged farrowing to avoid still birth and increased risk of farrowing fever (MMA) as well as the need for nurse sows to bring up surplus piglets may pose a larger challenge in housing systems where sows can move around and respond properly to any human interference. This hypothesis may be supported by the even higher piglet mortality rate of around 33 % of total born piglets seen in Danish outdoor production using the same genotype, (Sørensen and Pedersen, 2014).

PERSPECTIVE AND FUTURE RESEARCH

Concerns about the feasibility of the currently used genotype in less intensive sow farrowing housing systems for piglet survival and growth need to be further investigated, taking into account both short and long term consequences of large litter size. In addition, better documentation of the potential production benefits of the loose housing system with focus on piglet growth and survival as well as sow health and welfare is needed.

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ANIMAL WELFARE IN ORGANIC PIG PRODUCTION

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SUMMARY

Organic pig production is a clear alternative to conventional pig production providing the pigs opportunities to express natural behaviour and using a low level of antibiotics. These aspects are in line with the expectations of consumers. High piglet mortality and a high level of endoparasite infections in growing pigs are major challenges in organic pig production. Further possibilities for rearing entire male pigs and for keeping growing pigs on pasture should be investigated.

INTRODUCTION

Organic pork offers a clear alternative to the consumer due to a production form which differs substantially from indoor conventional pig production. Organic piglets stay outdoors on pasture until they are weaned late (at 7 weeks of age). After weaning, they are kept indoors on straw bedding at a relative low stocking density and with access to an outdoor concrete area. In Denmark, organic sows will stay at pasture 365 days a year. All organic pigs will have permanent access to forage and eat organic grown feed (95% of the ration). The piglets will not be tail docked but male piglets are castrated.

The organic pig production in Denmark is growing and 110.000 organic pigs were slaughtered in 2014, which is less than 1% of the total Danish pig production. More than 60% of the organic produced pork is exported. The market share of organic pork in Denmark is currently 2%.

The aim of this presentation is to show recent Danish results on animal welfare aspects in organic pig production with reference to conventional indoor pig production and to discuss future possibilities and challenges related to animal welfare in organic pig production.

ANIMAL HEALTH

A major health problem for sows is lameness. A Danish study in nine major organic sow herds and 46 conventional indoor sow herds showed that the risk for a sow being lame was 3.5 times higher in a conventional herd than in an organic herd (Knage-Rasmussen et al., 2014). The study further showed that the risk for an organic sow being lame was higher during summer than during winter. In a study in 11 organic sow herds, 150 sows were examined 1-3 days after farrowing. In total,

8.7% of the organic sows were diagnosed with the MMA-syndrome (metritis, mastitis, agalactia) (Grønborg et al., 2012).

Organic slaughter pigs have less respiratory problems but a higher risk of being skinny. A study in 16 organic and 50 conventional indoor herds showed that organic slaughter pigs have less skin lesions but a higher risk of being skinny (Bonde et al., 2006). The large proportion of organic pigs with low body condition may be due to a higher risk of being infected with round worms (helminths). A study based on meat inspection data showed that organic slaughter pigs with signs of helminth infections were estimated to be 50%, compared to 5% in conventional slaughter pigs, when data were corrected for a low sensitivity (Bonde et al., 2010). A high level of helminth infections has previously been found in Danish organic pig farms (Carstensen et al., 2002). Organic slaughter pigs have fewer problems with respiratory diseases than conventional slaughter pigs. The above mentioned meat inspection study showed that 17% of organic slaughter pigs have signs of respiratory diseases compared to 42% in indoor conventional slaughter pigs.

Organic pigs seem to be more robust than conventional pigs. In a Danish study, faecal samples were taken of organic and conventional slaughter pigs and examined for *Salmonella* (Bonde & Sørensen, 2012). An ELISA test for a *Salmonella* immune response on meat juice from the same pigs was made. It appeared that although organic pigs have a higher prevalence of positive ELISA tests (indicating that the pig has been infected with *Salmonella* at some point of time in life) there were fewer organic pigs being potential shedders (having *Salmonella* in faeces). An interesting interaction was found. If a conventional pig had a positive ELISA, the risk of being a shedder was higher, whereas if an organic pig had a positive ELISA, the risk of being a shedder was lower. This indicates that organic pigs may be more robust to *Salmonella* infections than conventional pigs and thereby cause less risk for contaminating meat with *Salmonella*.

MORTALITY

Piglet mortality is a major problem in organic pig production. A study including 2480 farrowings in seven large organic sow herds during a year (2007/08) showed that 33% of all piglets born died before weaning (Sørensen & Pedersen, 2013). It was estimated that 9% of the piglets were stillborn. The mortality appears to be higher than reported from outdoor systems in other countries (Sørensen & Pedersen, 2013). Higher Danish piglet mortality may be due to a high litter size in Danish organic pig production. The genotypes used in organic Danish pig production is similar to what is used in Danish conventional pig production.

Studies on slaughter pigs (Hegelund et al., 2006) and on sows (Knage-Rasmussen et al., 2015) did not show any difference in mortality between organic and conventional indoor pig herds.

ANTIBIOTICS

The use of antibiotics in organic pig production is very low compared to conventional indoor pig production. A study on slaughter pigs showed that usage of antibiotic was 15 times higher in conventional compared to organic pig production (Wingstrand et al., 2010). A calculation based on 11 organic and 51 conventional sow herds (material described by Knage-Rasmussen et al., 2015) showed a 5 times higher use of antibiotics to sows in conventional sow herds compared to organic sow herds.

The rules for treating pigs with antibiotics are restrictive in organic pig production compared to conventional pig production. If an organic sow is treated more than three times during a year and a weaner/slaughter pig more than once during life, the involved pigs lose their organic status. Withdrawal time after treatment is twice of what it is in conventional production. Further, the diagnoses and the treatment of an organic pig need to be carried out by a veterinarian.

DISCUSSION

Naturalness play a major role in the view of animal welfare in organic farming (Verhoog et

al., 2004), which is in line with the view of animal welfare held by consumers in general (Sørensen & Fraser, 2010). In a sociocultural study, a group of Danish citizens were visiting an indoor conventional pig herd and an organic pig herd and asked for their immediate impression. They clearly preferred the organic production form (Boogaard et al., 2011).

The practise to keep slaughter pigs indoors and to castrate male pigs conflicts with the general values in organic agriculture. It is possible to keep growing pigs on pasture; however, the stocking density needs to be very low and the cost level is therefore high (Hermansen et al., 2014). Studies on rearing entire male organic pigs show that this can be done without animal welfare problems; however, the level of male pigs with boar taint is very high (Thomsen, 2015).

The health status in other European countries is similar to what has been found in Denmark (reviewed by Lindgren et al., 2014; Edwards et al., 2014), except for the piglet mortality. The high piglet mortality in Denmark can be a major barrier for future success. The possibilities to reduce piglet mortality through breeding and through improved management are currently being investigated in a major Danish research project. Endoparasite infection in growing pigs is a major barrier for keeping growing pigs outdoors. Research is needed for making robust and operational strategies for controlling helminths in outdoor facilities.

The low level of antibiotic usage found in organic pig production could indicate that sick pigs were not treated. However, an analysis on data from 16 organic slaughter pig herds did not show any relationship between level of disease and level of antibiotic usages (Sørensen, 2012). Further, the mortality in organic sows and slaughter pigs is not higher in organic than in indoor conventional pig production.

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THE INTELLIGENT PIG BARN

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ABSTRACT

Until now, production monitoring in pigs has mainly focused on growth, reproduction, feed consumption and mortality. However, in the daily management, pig producers also rely on additional observations related to animal behavior, e.g. in relation to climate regulations, and early intervention in case of productivity and welfare related problems, such as diarrhea, tail biting and fouling. In the ongoing PigIT research project it is hypothesized that a systematic placement of cheap sensors and cameras in the production pens combined with methodological developments to integrate the information from these sensors will enable automatic detection of behavioral patterns reflecting impaired production and welfare.

INTRODUCTION

As it is stated in the project description of the PigIT project¹, the major welfare problems affecting the productivity of growing and finishing pigs are intestinal (i.e. diarrhea, affecting mostly weaners) and respiratory (affecting mostly finishers) diseases. Other major welfare issues are tail biting and undesired excretory behavior (fouling) with sudden appearance of filthy floors.

Until now, computer based production monitoring in growing pigs has mainly focused on growth, feed consumption and mortality. However, in the daily management, pig produc-

ers rely on additional observations related to animal behavior, e.g. in relation to climate regulations, and early intervention in case of economic and welfare related problems, such as disease and tail biting. These behavioral observations also serve as early indicators in case of feed and growth related problems.

Several research projects described in the literature have tried to develop methods for automatic monitoring in pig production. Previous efforts in Denmark have (with a few exceptions) been focused on monitoring sows, but in the PigIT project, the ambition is to adapt their methodology to growing pigs and to go a step further and integrate the monitoring methods in active decision support and regulation.

It is the hypothesis of the project that a systematic placement of cheap sensors in the production pens combined with methodological developments to integrate the information from these sensors will improve the production process and thus add significant value to investment in the sensor technology. The potential benefit will be seen in productivity as well as in the welfare of the animals in the systems.

SENSORS AND DATA

In the PigIT project, the strategy is to rely on vision technology and cheap standard sensors installed in and around the pens (no sensors are positioned on the pigs). The aimed observational unit is a pen of weaners or finishers.

¹ www.pigit.net

Figure 1 illustrates the sensor infrastructure of a project herd with sensor based measurement of temperature, water consumption and feed intake at pen level. Furthermore, cameras installed above the pen allow for vision based assessment of activity and live weight of the pigs. At section level, temperature and humidity are monitored by data retrieved from the climate computer in the herd. In addition to the automatic registrations, farmers record cases of tail biting, diarrhea and fouling.

Figure 2 shows sensor data collected in two pens (a double pen as illustrated in Figure 1(b)) over a week in February 2015. Water consumption is aggregated per hour and shows a clear diurnal pattern. Feed consumption is extracted from the feeding computer and is shown as kg feed per feedstuff per day (including water since it is a liquid feeding system). Whereas the water consumption reflects the behavior of the pigs, the amounts fed are basically decided by the farmer and controlled by the feeding computer.

The pen level temperature plots show that the local temperature fluctuates over time and varies considerably (2–4 °C) between the two positions in the pen (see Figure 1(b)). For the week shown, it seems that the local temperatures measured close to the aisle correspond quite well to the temperature measured at section level, whereas the temperatures measured at the

drinking nipple at the back of the pen are higher. The section level temperature and humidity shown at the bottom of the figure are controlled by the climate computer and they will to a large extent reflect decisions made by the farmer.

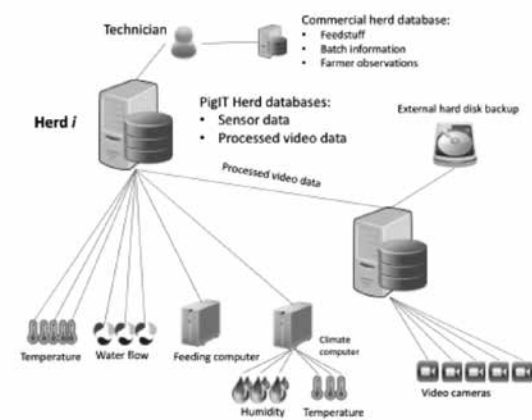
Vision data from the cameras (not shown) are used for live weight estimation and activity monitoring. In some herds, data from manual weighings of the pigs are also available. In addition to the sensor data, farmer observations of fouling and diarrhea are also shown in Figure 2.

DATA FILTERING AND EARLY WARNING

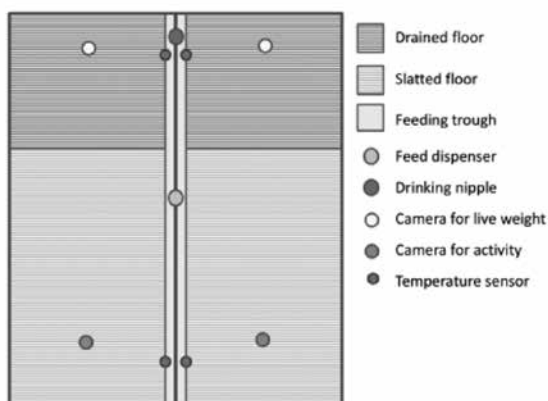
The idea of an early warning system is to automatically detect patterns in data reflecting impaired production or welfare. Welfare problems are primarily expected to influence the behavior of the pigs as expressed by the activity level and the drinking pattern. Other kinds of data as for instance the humidity, the local temperature or the feed allocation may serve as explanatory variables or risk factors.

Several methods like hidden Markov models (Aparna et al., 2014; Udipi, 2014) or state space models (Madsen et al., 2005; Cornou and Lundbye-Christensen, 2012) may be applied in the detection of impaired welfare.

In the PigIT project, a state space model in terms of a multivariate dynamic linear model is applied



(a) Data infrastructure



(b) Sensors and pens

Figure 1. The sensor and data infrastructure of the herds of the PigIT project. Data on humidity and temperature from the climate computer are at section level. All other information is at pen (or double pen) level.

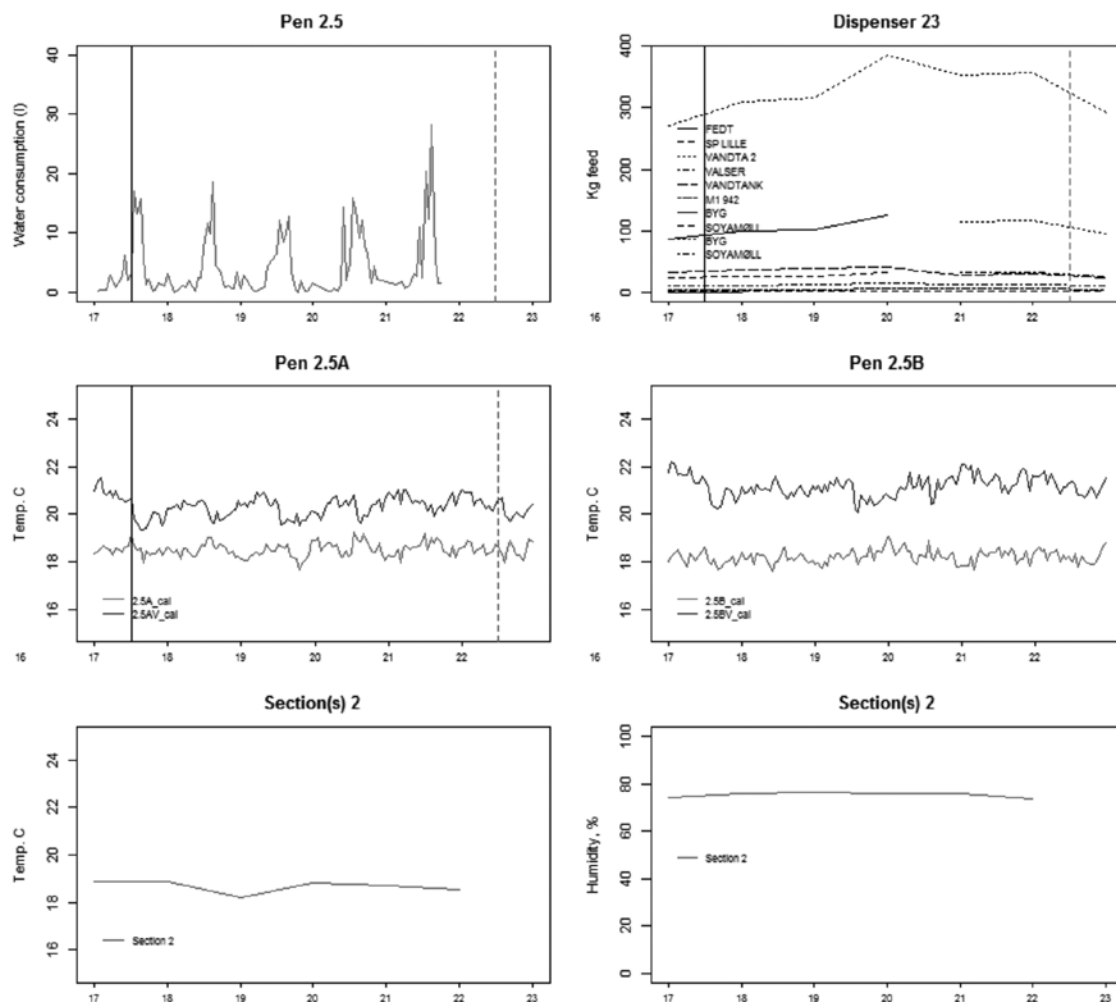


Figure 2. Sensor data collected over a week in February 2015 for the double pen 2.5A/2.5B in Section 2 of a herd. Upper panel: Water consumption per hour (left) and feed intake (liquid feed) per day (right). Middle panel: Local temperature at the drinking nipple (dark grey) and at the aisle (light grey) for both pens. Lower panel: Temperature (left) and humidity (right) at section level. On the 17th, fouling is observed in Pen 2.5A (black vertical line) and on the 23rd, diarrhea is observed in the same pen (black vertical dashed line).

for detection of fouling and diarrhea in a pilot study by Jensen et al. (2015). The basic idea behind the use of such a model for early warning is that as long as production and welfare remain at the same level, the model will be able to provide unbiased (and rather precise) forecasts for the next observations, whereas systematic forecast errors (over or underestimation) are taken as an indication of an out-of-control situation. In the following a short summary of the results from Jensen et al. (2015) is given.

The data applied in the study were water intake, feed allocation and manually collected live

weight observations. The multivariate approach enables us to combine information from (in this case) three different data sources and take their interconnectedness into account.

An observation is a vector holding three elements (water intake, feed allocation and average live weight) and it is described by an observation equation linking the observation to an underlying unobservable parameter vector which evolves over time according to a system equation. Both equations include random terms of which the variance components are estimated from data. For more information about the

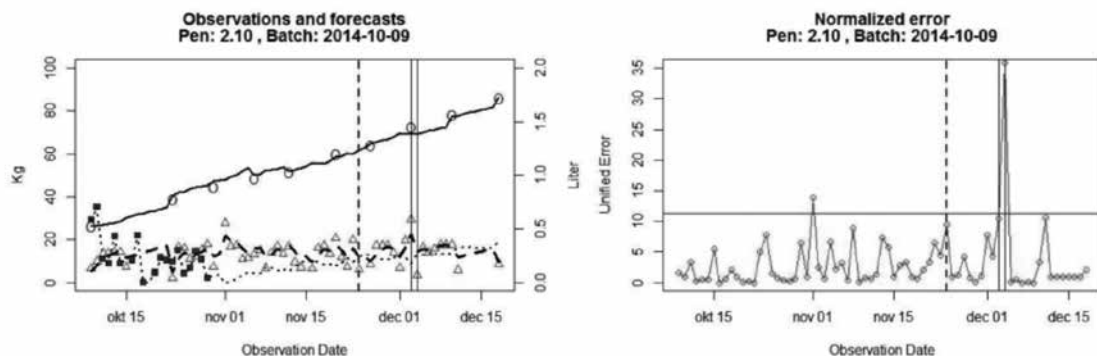


Figure 3. Example from Jensen et al. (2015). Left panel: The observed values of mean live weight (circles), feed allocation (triangles) and water flow (solid squares) per pig in a batch. In addition, the filtered mean values, estimated by the model, for live weight (solid line), feed allocation (dashed line) and water flow (dotted line). Right panel: The unified forecast errors corresponding to the observations depicted in the left panel. Vertical lines indicate cases of diarrhea (dashed) and fouling (solid).

modeling approach, reference is made to West and Harrison (1997).

The early warning system is based on a sequential comparison of the forecasted observation at time t (given all observations until time $t-1$) and the actual observation at time t . In case of a significant deviation between the forecast and the observation, a warning is given as illustrated in Figure 3.

As it is seen in the figure, diarrhea is observed on the 23rd of November (dashed vertical line) and fouling is observed on the 3rd and 4th of December (solid vertical lines). The right panel shows the unified forecast error with a threshold for warnings. Whereas no warning is given for the diarrhea, a clear warning is raised for the fouling. Several reasons can be given for the missing warning for the diarrhea: missing water flow data at the time of the event, insufficient calibration or simply the fact that no automatic warning system will be perfect.

PERSPECTIVES

As it is said in the project description, the main novelty of the PigIT project is the systematic and intensive use of sensor data combined with video surveillance for monitoring based on advanced data filtering techniques. It is expected that this will help the farmer to monitor welfare and productivity related issues on his farm, and more importantly, to help him make timely interventions in order to avoid problems arising.

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THE USE OF ANIMAL WELFARE INDICATORS

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SUMMARY

As the global population increases and demand for livestock products increase, there will be a need to explore new markets which will need to meet certain changing welfare standards. Thus, there remains a need to be able to accurately assess welfare on farm. At any given time, an animal's welfare ranges on a scale of very good to very poor, containing physical and mental elements. The physical elements, such as behaviour, physiology, health, productivity and pathology, can be measured relatively easily, in an experimental setting, but the mental elements, i.e. emotional state, remain much harder to quantify. Further refinement of current measures and the development and validation of new measures, may ultimately enable us to determine an animal's mental state and so be able to really quantify an animal's welfare to the satisfaction of our stakeholders, including the consumer. However, superimposed upon this challenge are the application of animal welfare indicators to the production chain setting (farm, transport, and slaughter) and the difficulties of identifying individuals at risk within a group. A major development in on-farm assessment was the recent Welfare

Quality® project funded by the E.U. This project has resulted in the publication of assessment protocols for several species, including pigs, with a focus on animal-based measures chosen on the basis of validity, reliability and feasibility, and also objectivity. The Welfare Quality® pig protocol is a fine starting point and it leaves the door open to modification of its measures as scientific discovery increases our knowledge. For future public acceptability and the sustainability of pig meat production, it is essential that we continue to assess welfare across the chain, continue to improve our methods of assessment and be transparent in our recording and reporting, self-evaluating and amending current practice as necessary to improve pig welfare and maintain consumer trust.

INTRODUCTION

The global population is projected to reach 9-10 billion by 2050 and there will be a corresponding increase in animal product consumption of between 50-70% over 2011 levels. The major increase in consumption of animal protein is projected to be in the developing world and in particularly in newly industrialized countries within South America and Asia.

Global production patterns and export/import markets will continue to evolve to meet these needs. However, although the major growth in production and consumption may be in societies with different historical standards in terms of farm animal welfare, the globalization of trade means that meeting certain welfare standards will open up market opportunities, and thus, we can expect to see EU-level welfare standards begin to be replicated elsewhere. Superimposed upon legislated welfare standards, there will continue to be further pressure from consumers and/or retailers to keep 'raising the bar', either out of genuine concern for animal welfare or for market edge, and for producers to carry out further adjustment in housing and management systems in order to meet these ever increasing expectations (Webster, 2001). However, for increasing standards to have any positive effect on animal welfare in reality, we need to be confident that our welfare assessment measures are valid and truly reflect how the animal is functioning and, perhaps more importantly, feeling.

ANIMAL WELFARE AND ITS ASSESSMENT

Historically, animal welfare has been defined under one of three intersecting themes or approaches. These are biological functioning (Broom, 1986), 'naturalness' (Kiley-Worthington, 1989) and feelings (Duncan, 1993). The biological functioning theme of animal welfare enables us to focus on discreet measurable parameters, such as health indicators, production measures, measures of physiological functioning, incidence of behaviors, etc. and combine multiple measures to draw an overall picture of the welfare of the given animal at the time, or prior to, when the measures are taken. The 'naturalness' theme focuses on the extent to which the animal is leading, or can lead, a life in which it is free to express its natural behavioral repertoire, with the idea that an animal being able to experience or fulfill its inherent nature, will have good welfare. The third theme concerns the feelings, emotions or affective states of the animal, with the broad idea that for an animal to be experiencing good welfare, it should not only be devoid of negative emotions, such as anxiety or fear, but

should also be experiencing positive emotions, such as pleasure or happiness. These themes do not each exist in isolation and it is commonly acknowledged that there is a degree of overlap between them, and that in attempting to best establish the welfare state of an individual, there should be elements drawn from all three approaches (Fraser et al., 1997).

As animal welfare scientists, we have done a good job in increasing our fundamental knowledge about the welfare of an individual animal, and we can now incorporate a great many potential measures of an animal's biological functioning and are beginning to get an understanding of the animal's emotional state within an experimental setting. However, the reality is that commercial farm animal production is not the same as an experimental setting. On a pig farm, we may be faced with needing to assess thousands of animals in large groups, in a very limited time period, rather than a few individuals with much more time. Thus, welfare assessment of animals in an on-farm setting is very different from the laboratory and the range of indicators that we can use on farm is smaller.

HISTORICAL USE OF ON-FARM WELFARE ASSESSMENT

During the 80s and 90s, there were an increasing number of food-related human health scares – or at least increased reporting and media coverage – including microbiological, chemical contaminant or zoonotic disease events (Knowles et al., 2007). With consumer confidence in farming perhaps at an all-time low, various members of the farm-to-plate retail chain began developing and introducing quality assurance schemes in order to demonstrate that food was being produced using quantifiable or auditable methods that would be mostly ensuring food safety. There was very quickly a proliferation of schemes – some retailer-driven, some industry-body-driven, some government-driven and some NGO-driven. As the 90s progressed, it became apparent that the proliferation was disadvantageous and the consumer was now confused and unsure what the various standards actually meant. There then followed a period of consolidation and

roll-out of standards under a more unified umbrella – for example the Red Tractor Assurance standards in the U.K. or the EUREGAP (now GLOBAL G.A.P) standards now operating within the global marketplace. However, the attention to animal welfare within assurance schemes is variable. Clearly some schemes were always directly aimed at animal welfare, such as the RSPCA's ground-breaking Freedom Food or Global Animal Partnership's 5-Step Animal Welfare Rating Standards (Duncan et al. 2012), whereas others were primarily quality assurance schemes with little welfare content, such as the U.S. National Pork Board's original Pork Quality Assurance scheme but subsequently re-launched with greater emphasis on animal welfare as PQA+. Certainly now most assurance schemes include a welfare component, at least by name, but the ways in which welfare is assessed within the schemes, varies.

ANIMAL-BASED AND RESOURCE-BASED MEASURES

Many of the less welfare-focused assurance schemes focus assessment on elements of the housing and husbandry systems, rather than the animals themselves – i.e. they include more in the way of resource-based measures (Webster, 2005). They may define the type of housing system (example – no farrowing crates permitted), the type of flooring (example – part of the floor must be solid and bedded), the air quality (example – ammonia levels must be below 25 ppm), the temperature (example – temperature must be within thermal comfort zone appropriate for given age of pig), the space allowance (example – sows must have at least 2.25 m² unobstructed floor area), access to feed and water, and so on. They may also describe elements of the husbandry, such as staff experience and training, minimum weaning age, minimum castration age and use of pain relief, use of hospital pens and euthanasia action plan, veterinary health plan, handling techniques, daily observation routines and so on. All of these resource-based measures are set on the assumption that adhering to them may at least provide an overall acceptable welfare level, assessed at the group average.

In terms of animal-based measures, historically these have been production and health focused, and might include such measures as mortality and morbidity, body condition scores, litter size – alive, dead, mummified, lameness incidence, skin lesion incidence, tail-biting incidence etc. Some of these data, like mortality, morbidity and litter size can be collected direct from computerized records, meaning on the positive side that all animals within the unit can be included in the dataset but with the caution that the data are not recorded by an independent auditor. Other data, such as lesions scores, body condition scores, lameness and tail damage will need to be measured directly and on a subset of animals. Of course these last few measures can give a good indication of the amount of negative social behavior that may be occurring within a given system, but they are indirect measures. Expert opinion considers it important to include more than just health-associated animal-based indicators, and for pigs, these may include feeding and social behavior and responses to novel objects (Whay et al., 2003).

More recently an EU-funded project – Welfare Quality® - was carried out with the aim of developing European standards for on-farm welfare assessment and to develop practical strategies to improve welfare (Blokhuys et al., 2010). Importantly, there was a greater focus on animal-based measures and measures of positive as well as negative welfare. There was also good involvement with stakeholders and a novel top-down approach to defining 12 important welfare criteria with 26-35 resource-based and animal-based measures (depending on phase of production), grouped under 4 main welfare principles of good feeding, good housing, good health and appropriate behavior. There are also protocols for recording data at the slaughterhouse. Once the measures are scored, a mathematical model then produces an overall assessment of welfare within the assessed system.

CHALLENGES AND CONCLUSIONS

However, although on-farm welfare assessment has improved greatly over the last 10 years, it

remains a relatively inexact science compared to experimental welfare research, constrained by a lack of easily applicable welfare indicators, the ever-increasing size of farms and the issue of having to extrapolate and generalize a score based on a potentially small sample size, to the experience of individuals within a large population. For example, the PQA+ system recommends a minimum sample size of 294 pigs, when assessing a population of 10,000+ pigs. Clearly assessing under 3% of a population cannot give a true representation of the welfare status of each and every pig on that farm and even farms which have a similar mean score, may have quite different populations if variation around the mean is taken into account. There continues to be a need to develop novel indicators of welfare, which are non-invasive, easily observed and robust, (DeBoer et al., 2015; Telkänranta et al. 2014) and it is essential that as researchers, we continue to seek new discovery, but more importantly, application for our discovery through engagement with stakeholders throughout the supply chain.

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USE OF REGISTER DATA TO ASSESS ANIMAL WELFARE

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Register data are potentially attractive as they have been gathered for other purposes and are thus readily available. This presentation outlines criteria for assessing animal welfare using register data and provides examples of the usefulness of such data. The criteria for evaluation of animal welfare indicators in general include relevance, sensitivity, specificity, robustness, feasibility, prevalence, completeness and validation of aggregated measures. Some register data have potential for predicting welfare problems, but their use to provide an index is limited compared to on-farm obtained measures. However, register data may give added value when combined with primary data.

INTRODUCTION

There is a growing interest for assessing animal welfare on farms using animal based measures (Nielsen et al., 2014). Data collected on farm are expensive to collect, and there is therefore interest in investigating the use of register data. Register data, or secondary data, include data that have not been collected for a specific research purpose. Data collected for a specific purpose are referred to as primary data (Sørensen et al., 1996; Egenvall et al., 2011).

The obvious advantage of register data is their pre-availability, allowing a research project to potentially save time and money. Furthermore, they often comprise data from large populations, thus addressing sample size constraints. A major drawback of register data is that data collection is beyond the control of the researcher, so they may not meet the precise requirements of the researcher. In addition, it is frequently not possible to fully evaluate the quality of the data.

The objective of this presentation is to outline some general criteria for evaluating data with particular focus on the use of register data. An overview of databases in Denmark is provided, and the strengths and limitations of using register data are presented with examples.

EVALUATION OF REGISTER DATA FOR USE AS INDICATORS FOR ASSESSING ANIMAL WELFARE

Use of register data in research or for other purposes should adhere to the general methodologies recommended in the relevant scientific areas. For example, register data are often used in epidemiological studies, and therefore general epidemiological principles such

as definition of target and study population, specification of sampling methods and sample size etc. should be followed as outlined in various textbooks (e.g. Houe et al., 2004). Here, a brief outline of the focus points or assessment criteria is provided with emphasis on what should have particular attention when assessing animal welfare.

The focus points in assessing register data can be outlined as follows:

1. Relevance
2. Sensitivity and specificity
3. Robustness
4. Feasibility
5. Occurrence
6. Completeness
7. Validation of aggregated measures

Among these assessment criteria, 'relevance' particularly is judged by qualitative methods, whereas the other criteria can often be assessed using quantitative methods.

RELEVANCE

Relevance describes how close the indicator is to the target condition. Animal welfare cannot be measured directly but needs to be assessed indirectly through several welfare indicators. As a single definition of animal welfare does not exist, the judgement of the relevance of a certain indicator and/or an indicator protocol for assessing animal welfare often has to be done using expert opinion, with judgement based on their own perception of good animal welfare.

SENSITIVITY AND SPECIFICITY

Sensitivity describes how often the true occurrence of a target condition is actually detected when this condition occurs. Similarly, specificity describes how often an animal without the target condition is classified as such. If there are no clear measures available to characterise the target condition (e.g. fear), then we must establish a case definition instead (e.g. avoidance distance) that we believe is a good surrogate measure. The case definition is then used to establish the performance of a 'diagnostic test' measuring the distance.

ROBUSTNESS

The robustness describes the intra- and inter-observer variability, regardless of whether the 'observer' is a human being or a machine. The measure also includes whether the measure fluctuates over time.

FEASIBILITY

The feasibility is a judgement of how easy and cheap it is to obtain the measurements. This criterion is often the reason why easy-to-measure resource based indicators (e.g. space) are found more attractive than the time consuming measurement of animal based indicators (e.g. lameness).

OCCURRENCE

Occurrence refers to whether a condition in general occurs frequently enough to warrant attention. Some conditions may occur so seldom that it may not seem worth the effort to record them systematically. However, if they are associated with severe welfare problems, they may still be included. This criterion must therefore be evaluated together with relevance.

COMPLETENESS AND CORRECTNESS

Completeness is the proportion of observations that are actually recorded in the database and correctness is the proportion of recorded observations in the database that is correct. Thus, compared to the diagnostic situation, if the database recordings are considered 'a diagnostic test' then completeness corresponds to sensitivity and correctness to the predictive value (Hogan and Wagner, 1997).

VALIDATION OF AGGREGATED MEASURES

Even if the individual indicators have high relevance, sensitivity, specificity, robustness etc. they can be aggregated in different ways. Therefore, if several indicators are aggregated in a score or an index, the aggregated measure should also be validated.

The final selection of variables is a balanced consideration of all abovementioned criteria or assessment steps. In the following section, examples of evaluation of data are provided including both qualitative and quantitative

methods, and also including examples where it may be possible to improve poorly recorded variables to some extent.

DATABASES IN DENMARK AND EXAMPLES OF EVALUATION

In Denmark, establishment of databases is often embedded in legislation. These databases have recently been mapped and evaluated for their relevance for assessing animal welfare on farm. In pigs, the following 5 veterinary databases and variables were found to be suitable for assessment of animal welfare (database name followed by most important variables), (Houe, et al., 2012):

- Central Herd Register (CHR): Geographical location, species, herd size
- Movement database for swine, including herd identification, animal type, and number of movements
- A database containing meat inspection recordings for all slaughtered cattle and swine
- VetStat with medicine type, animal group, animal daily doses
- DIKO (Digital Control): Infringement of animal welfare legislation

In addition, several databases owned by private organisations contain relevant data, e.g. the database on efficiency control and the Danish SPF company database. However, the use of these data requires permission from farmers.

Some of the above mentioned data have been evaluated in more depth in recent projects. Meat inspection data for 2012 have been analysed to study their potential for inclusion in the establishment of an animal welfare index (Denwood et al., 2015; Nielsen et al., unpublished). Among 88 meat inspection codes available for sows and pigs, 47 were excluded due to lack of relevance for assessment of animal welfare on the farms and 2 codes were excluded due to low prevalence and relatively low animal welfare impact. As it is known from earlier studies that sensitivity can vary between abattoirs (Enøe et al., 2003), the remaining 41 codes were included in statistical models to see if it would be possible to adjust the particular

code for an abattoir effect. In this process some closely related codes were combined (e.g. abscesses with different locations). After the whole selection process, 15 codes in slaughter pigs and 23 codes in sows were found useful for further use. The project demonstrated the need for well-defined protocols for observation and recording of data. The potential usefulness of these variables can have in a full animal welfare index still needs to be determined.

There seems to have been most projects on the evaluation of completeness for register data in cattle, probably due to the fact that this frequently involves recordings on the individual animal level. For example, an evaluation of the cattle databases in the Nordic countries showed that completeness for diseases related to lameness was very low, i.e. on most occasions much lower than 50% (Lind et al., 2012). A more indirect way to validate a database is to clearly describe the data collection process and establish if logical checks in the data entry process exist, as have been described for the 'VETstat' database (Jensen et al., 2004).

Concerning validation of register data for use in a full index model, a study in 63 sow herds used register data on meat inspection, mortality and medicine consumption to construct an index. This index was then compared with an index based on 20 clinical and behavioural measurements (Knage-Rasmussen et al., 2015). It was not possible to show a linear relationship between the two indices. Similarly, in cattle it has not been possible to establish an index based on register data. However, different studies have shown that certain selection of indicator combinations can indicate problematic areas in relation to welfare (Otten et al, unpublished data; Sandgren et al., 2009). Taken together, these studies indicate that register data have potential in welfare assessments, but they perform best when used to assess 'parts' of welfare. More analysis is needed to find the best combinations for use in a full welfare assessment, and register data cannot stand alone as welfare indicators but must always be supplemented with additional on farm recordings.

DISCUSSION AND CONCLUSION

Evaluation of register data to be used for assessing animal welfare is a complex process. This may be the reason that only few studies are conducted only evaluating some of the 7 mentioned focus points. Importantly, when register data are to be used, they must undergo thorough evaluation, and the selection of indicators must be transparent to the user of the data. The optimal use of register data in assessing animal welfare has not yet been established. However, what results are available indicate that register data should be supplemented with additional on farm recordings.

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DEVELOPMENT OF A NATIONAL ANIMAL WELFARE INDEX

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Developing animal welfare indices at farm level is a major challenge. The aim of our project is to go beyond farm level and develop national animal welfare indices for cattle and pigs intended to monitor changes over time in animal welfare. The indices is based on information from cross sectional farm data and existing databases and animal welfare scores derived from expert opinions. Emphasis is on developing operational and robust protocols for obtaining the needed information in a relatively short time and at low costs but still represent a valid animal welfare outcome.

THE NEED FOR A NATIONAL INDEX

Animal welfare is of a topic of large importance for many consumers and citizens (EU-barometer 2007, Kjærnes & Lavik 2007). Various approaches have been used to increase the level of animal welfare both in Europe and more specifically in Denmark. Market driven animal welfare has been advocated as a way forward, putting much of the responsibility for increasing animal welfare on the consumers. A more traditional approach has been to introduce legislative measures to ensure that there are minimum standards that are met.

Irrespective of the approach chosen, the focus is typically on one or a few parameters. One of the main changes in animal welfare legislation in recent years is the banning of crated pregnant sows. This however only focuses on one aspect of animal welfare and it may be that the total sum of animal welfare does not improve or indeed may in some cases decline. (In the present example, e.g. some problems with heavy sows mounting other sows have been reported). In the same way many of the so called welfare schemes focus on a relatively narrow selection of parameters, where the implementation may to lead to unforeseen results.

A national animal welfare index will make it possible to assess the results of different activities that may affect animal welfare, whether they are the result of legislation or animal welfare schemes.

ANIMAL WELFARE IS MULTIDIMENSIONAL

To be able to ascertain whether a given legislation or scheme does indeed increase the welfare of the animals it is desirable to have a valid assessment of the welfare of the animals. Among several definitions of animal welfare (Fraser et al 1997, we have chosen to focus on

only one in this project - that animal welfare is about what the animal experiences (affective state).

Using only one animal welfare definition makes easier to understand criteria for including or excluding measure candidates. An important part of the construction of animal welfare scores is the weighting assigned to the various measures, and here as well using a single definition gives a greater transparency. A final advantage of using only one approach and specifically affective state is that it is the one used by the Welfare Quality® project (Botreau et al 2007).

The most complete and used farm level animal welfare assessment scheme is Welfare Quality®. The Welfare Quality® protocols have been criticised for being too time consuming and expensive. In our project we have chosen to use the general structure developed in Welfare Quality® to make a robust and operational protocol and using a complete Welfare Quality® protocol a reference value.

HOW TO REPRESENT A VARIETY OF FARMS IN A NATIONAL LEVEL INDEX

Our protocols are similar to Welfare Quality® based on animal based measures which allow us to assess animal across different production systems. While we prefer animal based measures as animal welfare measures, the use of resource based indicators is considered when they offer a faster or more robust alternative.

The use of animal based measures obtained from databases (medicine usage, meat inspection, mortality data) not gathered for assessing animal welfare at a national scheme, may be more valid at a national than at an international level due to national rules and traditions. While the data from these databases are very attractive on account of them being "free" (since they already exist), care should be taken in choosing them (see Houe et al., this volume). Special emphasis should be put on the appropriateness/validity of the data since they have been gathered for another purpose.

CONSTRUCTION OF THE PROTOCOLS

It was decided to divide the pig protocol into four, one for farrowing sows, one piglets, one for pregnant sows and sows in the insemination unit, and one for weaners and fatteners. With the help of national and international experts, a gross list of possible measures was constructed. Many of the measures came from other animal welfare protocols especially from Welfare Quality®, but the list also contained new measures (e.g. lachrymal stains, and hairiness in piglets as well as data from databases e.g. meat inspection data, see Houe et al. this volume). The gross list contained a total of 239 different on farm measures. A thorough literature review was done to assess the validity, inter observer repeatability and feasibility of the measures considered. A number of the measures were also investigated on farm. The result of the evaluation was a reduced net list of 102 on farm measures, with between 20 and 30 measures for each animal group.

Overall the resulting list resembles the Welfare Quality® protocol, however with some important differences. First of all, some of the most time consuming measures, in particular those of social behaviour, have not been included in the current protocol. Secondly, in the Welfare Quality® protocol, piglets and sows are assessed together, and there are very few measures on piglets. In the current project, they are separated and more emphasis is put on piglet welfare, both in general and on its possibility of interaction with the sow. Finally, in our current protocols we place more emphasis on resource based measures.

At present, we are visiting pig farms using both the Welfare Quality® protocol and our preliminary index protocols. The data will be used for the validation at farm level and final formulation of the protocol together with the data from the databases.

THE WEIGHTING AND AGGREGATION OF THE MEASURES

The weighting of measures is a central part of the construction of an animal welfare index. Most welfare assessment schemes make use of

expert opinions for solving the weighing task (Veissier et al. 2007). One problem with using expert opinions is that we do not know enough about what the varying backgrounds of the experts mean for how they assess different types of measures (e.g. resource based versus animal based measures) or welfare consequences (e.g. reduced health versus frustrated behavioural need). In the present project, there is a work package run by Peter Sandøe and colleagues at the Department of food and resource economics at the University of Copenhagen that is attempting to uncover this. The different groups of experts to be studied are veterinarians, agronomists and biologists, all working with different aspects of welfare assessment or research on cattle or pigs. Not only the educational background but also the current position may influence the assessment, and therefore the work package also looks at the opinions of animal welfare inspectors, agricultural advisors and researchers. The result of the work package will give valuable information to be used for determining how to recruit experts for the assessment of the various measures.

After having given weights to the measures, they have to be aggregated. With increasing aggregation there is by necessity also a loss of transparency (since the same result can be reached in more than one way). The aim of the project is however to create one national index for pigs and one for cattle, i.e. something that requires a high level of aggregation. Combining the need for a high level of transparency with the overall aim, we will present the results of the project aggregated on both the level of the animal welfare principles formulated in Welfare Quality® and as a combined animal welfare score.

The farm recording for making an evaluation of our farm level protocols using Welfare Quality® as reference will be completed in 2015. In parallel a model for weightings from the expert opinions will be developed. After having finished the farm visits and aggregated the data, we will continue to combine measures from both on farm visits and databases and compare the result with those of the WQ assessment.

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ETHICAL MEAT PRODUCT DIFFERENTIATION AND CONSUMER RESPONSES

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SUMMARY

Animal production enterprises are facing progressive increase in meat demand in emerging markets (i.e. BRIC countries), and more fragmented demand in mature (i.e. Western) markets. To respond to those two parallel trends, product differentiation, process- or product-based, is needed. Production differentiation characteristics could be represented by ethical (i.e. sustainable) farming practices. Ethical meat production appears to have great market potential, especially when constant and reliable signalling and information is given to consumers. However, current market realities indicate small market shares of ethical meat, despite academic evidence suggesting positive consumer attitudes towards sustainable meat production practices. This controversy points towards the existence of a gap between citizens' attitudes and consumer behaviour. This presentation thus aims to offer insights to respond to the following central question: *is informed consumer choice an option for bridging the attitudes-behavior gap and promoting ethically produced meat?* And, is ethical labeling a viable and convincing communication

alternative? Aiming at stimulating relevant dialogue, this presentation will attempt to contribute to the creation of a relevant research agenda. Ideally, this agenda should also incorporate questions that deal with the issue of consumer acceptance and how to communicate perceived benefits of ethical/sustainable meat to consumers in a trustworthy and convincing way. Ethical signaling (i.e. labels) should be able to meaningfully summarise the information conveyed, as consumers tend not to pay attention to detailed/technical information. However, only if certification bodies establish reputation in the markets will the corresponding labels be accepted as quality surrogates. Moreover, consumers appear willing to pay for ethical labels, yet this should be expected to differ per consumers' demographics, beliefs & attitudes, as well as per meat product and production process types. Consequently, the issue of ethical meat production from a consumer perspective requires a targeted strategic approach. Above all, ethical meat should "deliver" its value (i.e. hedonic, nutritional, social) to consumers as any other meat or food type, incorporating intrinsic qualities that would

justify superior experienced quality; only then, ethical process-based extrinsic quality cues (i.e. sustainable labels) will be able to fully deploy their market dynamism.

INTRODUCTION

In order to reply to the question of whether or not ethical meat production is a viable production differentiation strategy, it is meaningful to consider three types of responses: the consumers' response, the legislators' response, and the industry's response. This work deals with those three interrelated aspects that trigger a central question from both a scientific and a managerial point of view: *is informed consumer choice an option for promoting ethically differentiated meat?* In this respect, information about ethical production practices and consumer liking, production costs and prices, consumer willingness to pay (WTP) premiums, and ethical production-related labeling as a communication alternative will be briefly discussed. Animal welfare (AW) meat will be used as an indicative example of an ethical production process-differentiated meat.

Animal welfare and the consumer perspective
The effects of intensive farming on AW induced an increasing interest and awareness on behalf of citizens. The rising consumer concern about AW is reported in several studies since 1990's. Early studies, such as the one by Harrington (1991), initially observed little interest in production systems and their effects on AW by the majority of consumers; however, this fact starts changing since mid-1990s. Issanchou (1996) stated that AW is not a prominent aspect affecting meat choice, yet it will acquire more interest in the future. Verbeke & Viaene (1999) noted that AW is likely to become a key-issue in driving consumer preference in the 21st century. Harper & Henson (2000; 2001) indicated that consumers are increasingly influenced by ethical concerns and acquiring interest in AW. And Blokhuis et al. (2003) stated that AW is becoming an important component of the animal products' quality assurance for consumers. In a EU study of 2007, citizens rated the importance of farm animal protection with a mean score of 7.8 / 10, but with considerable variation

across the EU. Overall, accumulated evidence suggests that consumers' food quality perception is determined also by ethical principles incorporated into animal production, along with overall nature and safety of the end-product.

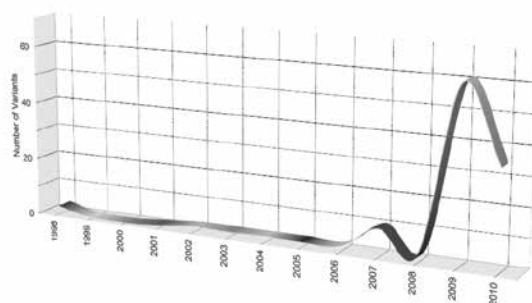
ANIMAL WELFARE, REGULATORY AND INDUSTRY RESPONSES

As a response, an increasing number of regulations on farm AW in general and for various animal categories have been used in the EU, on the basis of scientific evidence and systematic risk assessment performed by the EFSA: Farming of veal calves (EU, 1991a), pigs (EU, 1991b; 2001), laying hens (EU, 1999), broiler chicken (EU, 2007) and cattle and turkeys (2013). In the same EU study (2007) mentioned above, most citizens (86%) believed imported food from outside the EU should respect the same AW conditions. In N. America, farm AW has traditionally being an area for industry self-regulation, with a number of studies also pointing out public interest.

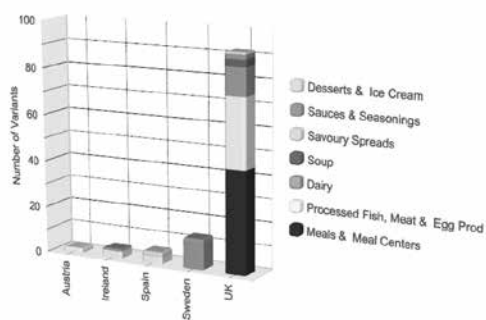
The meat industry, on the other hand, exhibited a slow response in relation to the increasing consumer concern about AW. Between 1998 and 2010, only 122 new products have been launched across all European markets with the term "animal welfare" in the product description (Mintel, 2010), almost half of which in 2009 alone (Figure 1). The large majority of those belong to the categories of "prepared meals" and "processed fish, meat and egg products", while almost 75% of those launches took place in the UK (Figure 2). It is interesting to note that those products carry in their label a number of additional sustainability, health or use-related claims beyond the AW, such as (mainly): ethical-animal, no additives/preservatives, ethical-environment, microwavable etc. (Figure 3). Globally, AW launches in the same period were negligible (only about 20 products, mainly in Asia-Pacific), so the issue remains a purely European phenomenon. However, when expanding to non-food products, the number of new product launches with the term "ethical-animal" on the label has globally been 7,431 since 1998 (Mintel, 2010), most of which (4,415) in Europe, while substantial numbers

Figure 1

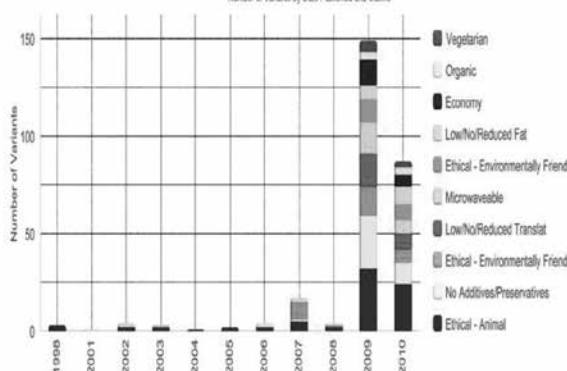
Number of Variants by Date Published

**Figure 2**

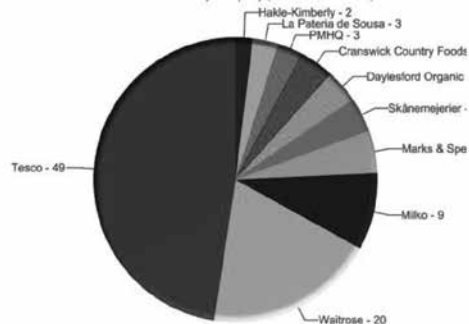
Number of Variants by Country and Category

**Figure 3**

Number of Variants by Date Published and Claims

**Figure 4**

Number of Variants by Company (Number of Variants)



can be also found in Americas and the Asia-Pacific. Going back to Europe and the food category, it is worth highlighting that the manufacturers of the 122 AW products launched between 1998 and 2010 have mainly been UK retailers, with Tesco (49) and Waitrose (20) taking the lead (Figure 4).

From the above, it becomes evident that several food companies & retailers label their products as AW-friendly. To a certain extent, this label differentiation strategy can be seen as a distortion of the competition, since relevant statements can be made with low risk of disclosure, as they cannot be verified. A number of codes of practice and farm assurance schemes (e.g. *Freedom Food* in the UK) have been issued focusing on farm AW. However, these are only standards and as such unable to verify real welfare status at animal level (Napolitano et

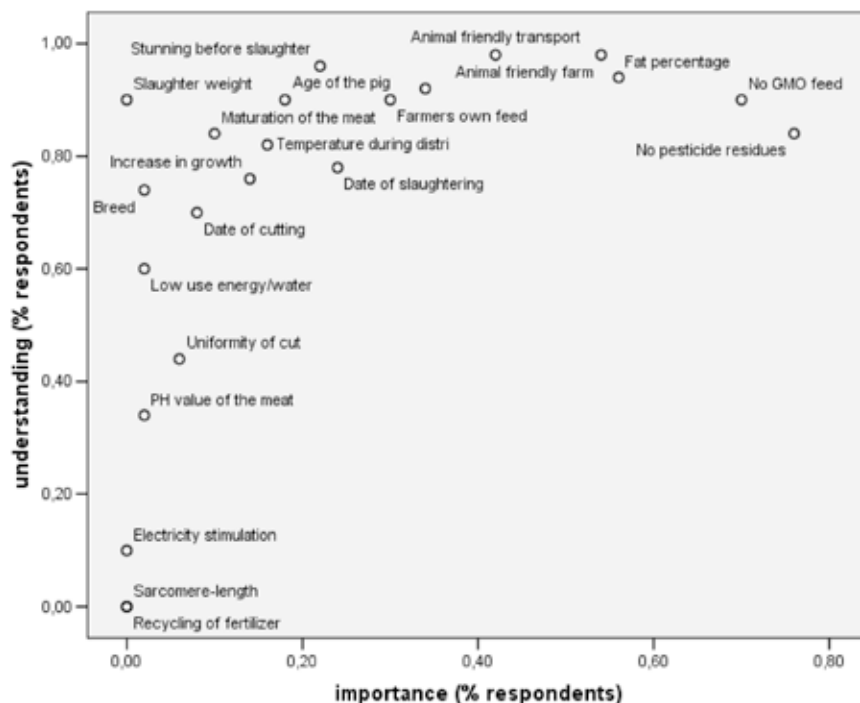
al, 2010). What is needed still is a monitoring scheme that would cover the whole process from farming to slaughter and ensures on-site inspection.

IS PROVISION OF INFORMATION ON ETHICAL MEAT PRODUCTION A VIABLE MARKET OPTION?

The above discussion leads us to pose a very crucial question:

- Would information on ethical meat production provided to consumers be a meaningful option to promote ethically or sustainably produced meat from a business and regulatory perspectives? And, if yes:
- Would the use of relevant claims and logos on product labelling be the best means to communicate to consumers the ethical/sustainable character of those meat products?

Figure 5



In this respect, evidence suggests that consumers seek more information about production methods to make informed choices (Harper & Henson, 2001). In a past EU survey (2005), consumers stated they are very rarely or never able to identify products from AW production methods. Grunert et al. (2002) postulated that animal welfare farming and transportation were among the most comprehensive and important information for meat consumers (Figure 5).

In a recent intervention experiment (Napolitano et al, 2007), when relevant AW-related information was provided, consumers clearly expressed a preference for products obtained through AW methods in terms of expected liking (subjects received only AW information) and actual liking (subjects received both information & the actual product). However, preference expressed without information (only based on sensory properties) yielded opposite results: perceived liking in blind tests was significantly lower than actual liking, and even less so than expected liking (i.e. "negative disconfirmation"). Thus, information about AW

practices can have a market impact on (high) consumer expectations about product quality. Information about AW is able to affect actual liking, since actual liking moves to the direction of the expectation (Napolitano et al, 2007).

On the other hand, farmers and the industry are concerned about extra costs incurring due to AW. However, relationship between costs and AW is quite complex (Appleby, 2005): first, only a small part of the consumer price (approx. 20%) reaches farmers (ESR, 2004); then, retail prices for animal products have been steadily increasing, yet not so payments to farmers (Fraser et al, 2001). However, moving from fully slatted floors to Freedom Food standards for pigs brings about only 4% increases in cost (Bornett et al, 2003), while marked improvements can be achieved by AW with only less than 1% increase to food prices (McInerney, 2004).

Price might not be the main determinant of ethical/sustainable meat products purchasing, however, since consumers interested in such

production methods usually seek the best value for money. Past evidence thus indicated a stated WTP of +5-20% for outdoor raised pig meat (Dransfield et al, 2005). More than half of EU-27 consumers showed a WTP of +5-25% for AW eggs (EC, 2005), while more than 40% of US consumers exhibited a WTP of +5-10% for meat from AW-raised animals (Swanson & Mench, 2005). Overall, when relevant information is provided: a) a positive expected WTP for AW (subjects received only AW info); and b) a positive actual WTP for AW (subjects received both info & the actual product) are to be experienced. Information about AW is thus able to affect actual WTP, since the latter moves towards the expectation (Napolitano et al, 2010). However, small market shares of ethical meat (e.g. organic) indicate a gap between citizens' attitudes and consumer behaviour (Krystallis et al, 2009).

CONCLUSION

Is ethical labeling an option? The Grunert et al. (2002) study (Figure 5 above) showed that the use of the "free range" claim is associated with AW, healthiness and quality, but also with higher product prices. Moreover, one should not forget that the use of health claims in meat (i.e. pork) is negatively associated with naturalness and overall attractiveness, much stronger than in other categories. In addition, any new ethical claim (i.e. AW) needs to "compete" against a number of well-established relevant claims and logos, such as those of the fair trade and organic schemes, which however do not prevail in the meat category so far. Finally, research conducted at the MAPP Centre (NOFORISK deliverable 34, 2007) reveals that more than 85% of Danish consumers pay no attention to any food label information at all. The above and other similar considerations need to be kept in mind when one tries to summarize research and market realities around the issue of ethical/sustainable meat production. Animal production enterprises are facing progressive saturation of markets, which consequently are becoming more competitive. Product differentiation is needed, process- or product-based.

Process characteristics could be represented by ethical/sustainable farming practices, e.g. AW standards, which therefore possess a great potential for differentiation without serious extra costs, through constant and reliable signalling systems and appropriate information given to consumers. However, only if certification bodies establish reputation in the markets will the corresponding labels be accepted as a quality surrogate. Labels should be able to summarise the information, as consumers tend not to pay attention to detailed/technical information. Consumers appear WTP for ethical process labels, yet WTP should generally be expected to differ per consumers' demographics, beliefs & attitudes, as well as by type of animal and aspect of animal welfare. Consequently, the issue of ethical meat production from a market perspective requires a carefully designed, targeted strategic approach.



Paul Hemsworth is a professor at the University of Melbourne and is Director of the Animal Welfare Science Centre, a joint centre of The University of Melbourne, the Department of Primary Industries (Victoria) and The Ohio State University. He is also an Adjunct Professor in the Department of Animal Science, The Ohio State University. Paul is an agricultural graduate with a PhD in animal behaviour and physiology. He is most recognised internationally for his research on the role of human-animal interactions on farm animal welfare and productivity. He has also collaborated with numerous colleagues studying the influence of a wide range of husbandry and housing systems on farm animal welfare and productivity. Paul has more than 180 peer-reviewed full publications and he teaches undergraduate and postgraduate subjects on animal behaviour and animal welfare at the University of Melbourne.

THE EFFECTS OF STOCKPERSON EDUCATION AND TRAINING ON FARM ANIMAL WELFARE

Paul H. Hemsworth, Animal Welfare Science Centre, Faculty of Veterinary and Agricultural Sciences, University of Melbourne, VIC, 3010, Australia

SUMMARY

The history of stockperson interactions with the animal affects the animal fear of humans, and in situations in which stockperson interactions are poor, through fear and stress, both farm animal productivity and welfare are at risk. Technical skills and knowledge of stockpeople are also important attributes in improving animal welfare. Research has shown that both technical and behavioural training of stockpeople are necessary to not only reduce the stress associated with handling and husbandry procedures, but also to improve the motivation in stockpeople to learn new technical skills and knowledge and to apply these competencies to the management of the animals under their care.

INTRODUCTION

Appreciating the factors that affect work performance is the first step in developing a strategic training program. Technical skills and knowledge are important attributes of the work performance of stockpeople and clearly training targeting these attributes is important in improving animal welfare. However, most stockperson training programs target

husbandry competencies rather than application of these competencies. Human-animal interactions are a key feature of modern livestock production and research has consistently shown that the quality of the relationship that is developed between stockpeople and their animals can have substantial effects on both the animals and the stockpeople.

THE CONCEPT OF THE HUMAN-ANIMAL RELATIONSHIP (HAR)

The HAR, which develops from the interactions between the partners, can be viewed to allow the partners to predict the actions and responses of their partners and therefore guide their own actions and responses. Consequently, the HAR can be studied by investigating each partner's perception of the other, which should reflect their perception of the relationship. The quality of the relationship from the animal's perspective can be studied by examining the behavioural and physiological response of the animal to humans. Similarly, the quality of the relationship from the human's perspective can be studied by examining the behaviour of the human towards the animal and the attitude of the human towards interacting with the animal.

THE HAR AND ANIMAL WELFARE AND PRODUCTIVITY

There are three main lines of evidence that demonstrate that negative or aversive handling by affecting fear responses to humans can affect the welfare of farm animals: handling studies under controlled conditions; observed relationships in the field; and intervention studies in the field targeting stockperson behaviour. This evidence will be briefly reviewed here but for a more detailed review readers are referred to Hemsworth and Coleman (2011) and Hemsworth and Boivin (2011).

Laboratory studies, particularly in pigs, have consistently shown that negative or aversive handling of farm animals, imposed briefly but regularly, increases fear and stress and reduces growth and reproduction. Field studies examining inter-farm correlations in the dairy, pig and poultry industries indicate sequential relationships between stockperson attitudes towards their animals and working with them, stockperson behaviour towards their animals, animal fear of humans and animal productivity. Studies in the dairy and pork industries have shown that cognitive-behavioural training of stockpeople, in which the key attitudes and behaviour of stockpeople are targeted, can be successfully used to improve animal welfare and productivity.

Thus there is a growing body of evidence that the HAR can have a substantial effect on the welfare and productivity of farm animals. Essentially, stockperson attitudes towards their animals and working with them, their beliefs about other people's expectations of them, and their beliefs about the extent to which they have control over

their ability to appropriately interact with the animals determine the nature and extent of their interactions with these animals. Furthermore, it is this history of stockperson interactions with the animal that leads to the development of a stimulus-specific response of farm animals to humans: through conditioning, farm animals may associate humans with rewarding and punishing events that occur at the time of human-animal interactions and thus conditioned responses to humans develop. In situations in which stockperson interactions are poor, through animal fear and stress, both animal productivity and welfare are at risk. This model of human-animal interactions is depicted in Fig. 1.

OPPORTUNITIES TO IMPROVE STOCKPERSON PERFORMANCE

STOCKPERSON ATTITUDES AND BEHAVIOUR

Studies in the dairy and pork industries (Coleman et al., 2000; Hemsworth et al., 1994, 2002) have shown that cognitive-behavioural training of stockpeople, in which the key attitudes and behaviour of stockpeople are targeted, can be successfully used to improve animal welfare and productivity. Cognitive-behavioural techniques basically involve retraining people in terms of their behaviour by firstly targeting both the beliefs that underlie the behaviour (attitude) and the behaviour in question and secondly, maintaining these changed beliefs and behaviours. This process of inducing behavioural change is a comprehensive procedure in which all of the personal and external factors that are relevant to the behavioural situation

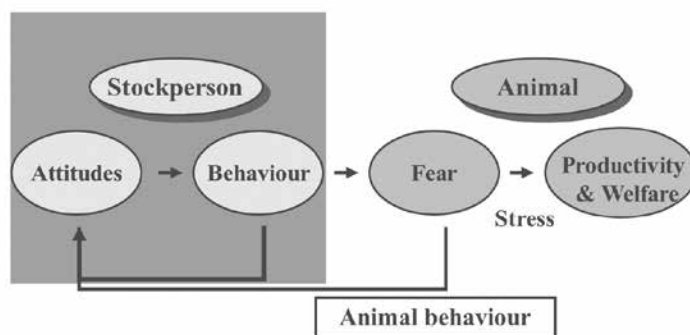


Figure 1. Sequential relationships between some key stockperson and animal variables. Attitudes in this model refers to attitudes of stockpeople to their animals and working with their animals.

are explicitly targeted. A detailed description of the key elements of this process of inducing behavioural change in stockpeople is provided by Hemsworth and Coleman (2011) and Coleman and Hemsworth (2014).

These intervention studies by Hemsworth et al. (1994, 2002) and Coleman et al. (2000) resulted in improvements in the attitudes and behaviour of stockpeople and, in turn, reductions in fear of humans and improvements in the milk yield of commercial dairy cows and the reproductive performance of commercial sows. The results of these intervention studies, taken in conjunction with handling studies and field observations on the relationships between stockperson attitudes, stockperson behaviour, animal fear and animal productivity (see earlier), provide a strong case for introducing stockperson training courses in the livestock industries that target the attitudes and behaviour of the stockperson.

TECHNICAL SKILLS AND KNOWLEDGE

Knowing and being skilled at the techniques that must be used to accomplish a task are clearly prerequisites to being able to perform that task. Thus these job-related characteristics will be limiting factors on job performance in situations where specific technical skills and knowledge are required to perform the tasks. There are little data on this for the agricultural industries, however this basic premise is widely accepted.

STOCKPERSON ATTITUDES AND BEHAVIOUR AND OTHER JOB-RELATED CHARACTERISTICS

Stockpeople clearly require a basic knowledge of both the requirements and behaviour of farm animals, and also must possess a range of well-developed husbandry and management skills to care for and manage their animals effectively. Therefore, while cognitive-behavioural training addressing the key attitudes and behaviour of stockpeople that affect animal fear is important in improving animal welfare, it is obvious that knowledge and skills training are also fundamental in improving the welfare of commercial livestock.

In addition to the direct effects of the stockperson's behaviour on animal welfare and

productivity, stockperson attitudes and behaviour may also have indirect effects by affecting other important job-related characteristics, such as job satisfaction, work motivation and motivation to learn. In many industries outside agriculture, the effects of motivating factors on job satisfaction and, thus in turn, work motivation are well recognized. Hemsworth and Coleman (2011) have proposed that the attitude of the stockperson towards the animal may affect job-related characteristics, such as job satisfaction, work motivation, motivation to learn new skills and knowledge about the animal, which in turn may affect work performance of the stockperson. In fact, Coleman et al. (1998) in a study of pig stockpeople found that the willingness of stockpeople to attend training sessions in their own time was correlated with attitudes towards characteristics of pigs and towards most aspects of working with pigs. Job enjoyment and opinions about working conditions showed similar relationships with attitudes. Thus, the stockperson's attitudes may indeed be related to aspects of work apart from handling of animals and consequently improvements in stockperson attitudes towards animals and working with animals may influence other important job-related characteristics, such as job satisfaction, work motivation and motivation to learn (Fig. 2).

TRAINING

The above discussion highlights the potential to utilize cognitive-behavioural training in conjunction with current technical skills and knowledge training to reduce handling stress and improve the motivation in stockpeople to apply these skills and knowledge competencies to the management of their farm animals.

Studies of cognitive behavioural intervention by Hemsworth et al. (1994, 2002) and Coleman et al. (2000) demonstrate that this approach to training is practical and effective among a wide range of stockpeople working in a variety of situations. Therefore, there is a strong case for introducing this type of training into the livestock industries. The training programme used as an experimental tool during research in the pig industry has been commercialised and is called 'ProHand' ('Professional Handling of Pigs Program', Animal Welfare Science Centre,

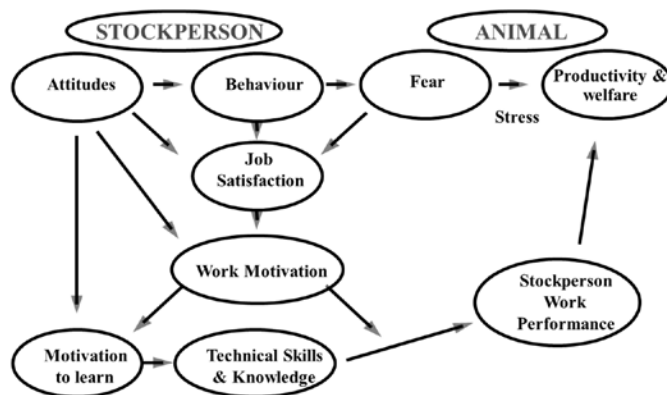


Figure 2. Relationships between stockperson attitudes and behaviour and other job-related characteristics.

2005). A similar training programme has been developed for the dairy industry and, after recent research, programmes for stockpeople at cattle, sheep and pig abattoirs are being developed in Australia. Training packages for stockpeople in the pig, poultry and cattle industries, based on the ProHand principles, have also been developed in Europe by the authors and their European colleagues as part of the European Union Sixth Framework (Ruis et al., 2010). An important characteristic of all of these programmes is that they are based on scientific research and their effectiveness in improving animal welfare and productivity has been demonstrated by properly designed intervention studies. Furthermore, because they use a standardised form of presentation, there is a reduced risk that the content will drift over time or that idiosyncratic and possibly unvalidated messages will be conveyed in the training.

CONCLUSIONS

This discussion underlines the need to understand not only the HAR but also the opportunities to improve the HAR in order to safeguard animal welfare. The attitudes of stockpeople are amenable to change, so stockperson training can improve the HAR in the livestock industries. Technical skills and knowledge are important attributes of the work performance of stockpeople and clearly training targeting these attributes is important in improving animal welfare and performance. Furthermore, the results presented here suggest that both technical and cognitive-behaviour training are necessary to not only reduce the stress associated with handling and husbandry procedures involving humans, but

also to improve the motivation in stockpeople to learn new technical skills and knowledge and to apply these competencies to the management of the animals under their care.

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Jeremy Cooper, CEO, Freedom Food, UK. Jeremy (Jez) Cooper has had a varied career, starting with 11 years military experience in the Royal Air Force. But it was his time working for Waitrose, Tesco and a merchant SME in the south of England, prior to him taking up his position as CEO at Freedom Food. "My previous experience has helped me to communicate with the retail sector but in terms of farming it has been a steep learning curve," he admitted. "Agriculture is very diverse, increasingly high-tech and full of extremely interesting and professional people." Whilst his father was stationed with the army, the family lived on a dairy farm. This sparked his first interest in agriculture, "I think the farmer must have got fed up with me following him around and asking questions". This is a tactic he has continued over the last 18 months in order to familiarise himself with the organisation and the industry. "I've had a policy of trying not to say no to anything in this critical initial period," Jez explained. "This has meant visiting numerous farms, attending agricultural shows, farmers meetings and technical conferences." Throughout he has been stuck by the passion, knowledge and professionalism of those working in the sector, often over several generations. "Everyone has been extremely welcoming and willing to share expertise," he enthused.

Jez is married to his wife of 30 years Sue has a son Rory and faithful Airedale Daisy. A keen sports person with a passion for Rugby, Motor Racing, Golf and in particular Football. "I once played against FC Kolding many years ago so I have experienced what a great country Denmark is".



Kate Parkes, Senior Scientific Officer, Farm Animals Dept., RSPCA. Following a degree in Biological Sciences from Oxford University in 2001 Kate continued her strong interest in animal behaviour by completing Edinburgh University's MSc in Applied Animal Behaviour and Welfare in 2003. Kate has worked in the RSPCA Farm Animals Department for nearly ten years and specialises in pig production and welfare, and is responsible for the development of the RSPCA's welfare standards for pigs, which are used by the Freedom Food scheme. Kate provides technical information to the Society's Welfare Outcome Assessment programme for breeding and finishing pigs and is also responsible for the provision of general scientific/technical information and advice on farm animal welfare issues, both within the RSPCA (e.g. technical support for the Society's pig welfare campaigning) and externally (e.g. to Governmental bodies). Liaising with organisations carrying out research relevant to the Society's interest Kate has represented the RSPCA on a number of scientific research project steering groups concerned with pig welfare, and currently represents the RSPCA on the Pig Health and Welfare Council.

GOOD WELFARE IS GOOD BUSINESS

FREEDOM FOOD IS THE RSPCA'S FARM ANIMAL WELFARE ASSURANCE SCHEME AND ETHICAL FOOD LABEL. KEY STANDARDS FOR PIGS ARE DEVELOPED IN PARTNERSHIP WITH THE FOOD AND FARMING INDUSTRY.

Jeremy Cooper, CEO, Freedom Food and Kate Parkes, Senior Scientific Officer, RSPCA, UK

Freedom Food Limited is a subsidiary charitable company of the Royal Society for the Prevention of Cruelty to Animals (RSPCA).

The primary object of the company is to prevent cruelty to animals by the promotion of humane

farming, transportation, marketing and slaughter of farm animals by implementing a set of rearing and handling standards approved from time to time by the RSPCA.

Further, the company seeks to promote

KEY ACHIEVEMENTS FOR FREEDOM FOOD

- Over 3,500 members
- One billion terrestrial farm animals
- Over 2,000 labelled products
- Almost a third of UK pigs
- Half of all UK egg production
- 70%+ of Scottish salmon production
- Animal Welfare Officers at abattoirs
- Compulsory CCTV in abattoirs
- Veterinary health plans

consumer preference for produce from live-stock producers that conform to the RSPCA welfare standards for farmed animals by identifying as many products as possible with a unique trademark and encouraging retailers to market these products.

Read more about Freedom Food on the web-site: <http://www.freedomfood.co.uk/>

THE RSPCA WELFARE STANDARDS

RSPCA welfare standards are developed in partnership with the food and farming industry. The scheme assures hatcheries, farms, hauliers and abattoirs to RSPCA welfare standards. The Freedom Food team of assessors carry out annual assessments in addition to monitoring visits by RSPCA farm livestock officers.

The RSPCA welfare standards cover every aspect of the animals' lives, including feed and water, the environment, management, health care, transport and humane slaughter/killing.

RSPCA WELFARE STANDARDS FOR PIGS

- Flooring: all pigs must have solid, bedded lying areas (minimum areas specified)
- Bedding: all pigs must have bedding material
- Nesting: farrowing sows must be given suitable material that allows nesting behavior
- Environmental enrichment: all pigs must have sufficient quantities of suitable enrichment material e.g. straw
- Stocking densities:
 - o for larger pigs (50 kg +) more space required than legal minimum
 - o sows /gilts total floor space allowances of 3.5m²/sow and 2.5m²/gilt – minimum lying areas also specified
- Farrowing crates: farrowing crates are not permitted; sows must be able to turn around freely at all times

THE FREEDOM FOOD PLAN FOR SUCCESS

- Key strategies:
 - o Brand
 - o Education
 - o Retail and foodservice
 - o Overseas development
 - o Species development
 - o Expand species, from current ten
 - o Working in partnership with RSPCA

They are designed to ensure a good quality of life, whether animals are kept on large or small farms, or in indoor or outdoor production systems. Amongst other requirements the standards ensure the animals are given a nourishing diet and a comfortable and stimulating environment which meets their physical and behavioural needs.

Freedom Food is the only UK assurance and food labelling scheme dedicated solely to improving farm animal welfare. Set up by the RSPCA 20 years ago and a registered charity, Freedom Food is the only farm assurance scheme where members must meet animal welfare standards set by the RSPCA.



POSTER ABSTRACTS

LIST OF POSTERS

Theme	Poster Titel	Page
A: HOUSING		
A1	Effect of a Rubber Top Layer on Concrete Floors on Gait Score in Group Housed Sows	66
A2	Confinement Before Farrowing Affects the Performance of Nest Building Behaviours but not the Progress of Parturition	67
A2	Effects of Temporary Confinement of Sows for 4 Days After Farrowing on Sow Behaviour and Saliva Cortisol	68
A4	Confined and Loose Housed Sows Had Similar Duration of Farrowing	69
A5	Behaviour and Production Traits of Italian Heavy Pigs as Affected by Two Floor Space Allowances	70
A6	Improving Sow Fertility and Production by Group Housing Management Towards Better Animal Welfare	71
A7	The Use of the Welfare Quality® Protocol to Compare the Welfare of Pigs Subjected to Two Different Housing Conditions	72
A8	Effect of Thermal Stress, Type of Floor and Number of Feeders in Growing Pigs: Preliminary Results	73
A9	Temporary Confinement of Sows in SWAP Farrowing Pens for 4 Days Reduces Piglet Mortality	74
B: NURSING SOWS		
B1	Nurse Sows for Super Numerous Piglets	75
B2	Farm Survey: Nurse sows' Reproductive Performance in the Subsequent Litter	76
B3	Saliva Cortisol Levels of Nurse Sows and Ordinary Sows Through Lactation	77
C: WELFARE OF PIGLETS		
C1	The Effect of Pen Density on Piglet Welfare and Growth	78
C2	Does Litter Size Affect Emotional Reactivity, Spatial Learning and Memory in Piglets?	79
C3	Higher Piglet Mortality in Designed Farrowing Pens Compared with Traditional Farrowing Crates	80
C4	Recovery from Intrauterine Growth Restriction in Piglets Defined by their Headshape: A Pilot Study	81
C5	Supplementary Milk during Lactation Improves Piglet Survival	82
C6	Potential Risk Factors for Piglet Mortality in Danish Organic Pig Production	83
C7	Neonatal Mortality in Piglets is more due to Lack of Energy than Lack of Immunoglobulins	84
C8	A solution for High Production Numbers in Farrowing Units?	85

Theme	Poster Titel	
D: CASTRATION AND PRODUCTION OF ENTIRE MALE PIGS		
D1	Bioactive Compounds – the Future Alternative to Castration to Prevent Boar Taint?	86
D2	Possible Future Production of Male Pigs in DK	87
D3	Consumer Acceptance of Meat from Male Pigs Not Surgically Castrated	88
D4	Ending Surgical Castration of Pigs	89
D5	The Effects of Analgesia and Local Anaesthesia on Blood Cortisol Concentration during Surgical Castration in Male Piglets	90
D6	Evaluation of Meloxicam and EMLA® for Pain Mitigation in Piglets Undergoing Surgical Castration	91
E: ENRICHMENT		
E1	Behavioural Changes Stimulated by Occupational Environmental Enrichment in Fattening Pigs in Intensive Farm System	92
E2	Evaluation of Costs and Benefits in the Use of Environmental Enrichment: an Innovative Tool for Supporting Farmers to Make the Right Choice	93
E3	The Use of Different Straw Dispensers in Weaned Pigs	94
E4	Evaluation of Novel Rope Flavors as Environmental Enrichment for Stalled Gilts	95
E5	Impact of a New Natural Manipulable Material on Pig Behavior and Health	96
E6	Do Increasing Amounts of Straw Increase Growing Pig's Oral Manipulation of Straw?	97
E7	Increasing Amounts of Straw Increase Growing Pig' Production and Health	98
E8	Influence of Different Straw Bedding Management on Welfare of Growing Pigs in Low Environmental Impact Farming System	99
E9	Effect of Enrichment Design and Amount on Durability and Use	100
F: TAIL BITING AND INTACT TAILS		
F1	Tail biting - Risk factors for being bitten and the effect of straw on tail lesion prevalence	101
F2	Associations of tail biting in pigs with immune parameters	102
F3	The SchwIP Management Tool for Tail Biting in Fattening Pigs: a Comprehensive Approach for a Complex Problem	103
F4	Tail Lesions on Carcasses of Irish Slaughter Pigs in Relation to Producer Association with Advisory Services	104
F5	Experiences with Intact Tails in Well-Managed Conventional Herds	105
F6	Straw Use and Prevention of Tail Biting in Undocked Pigs; a Survey of Housing and Management Routines in Swedish Pig Farms	106
F7	The Effect of an Enriched Environment on Biting Behavior and Performance of Finishing Pigs with Intact Tails	107
F8	Curly Tails: the Dutch Approach	108
G: SUSTAINABILITY		
G1	Free-Range Pigs Integrated with Agroforestry	109
G2	UHF – with Focus on Pig Welfare in Outdoor Production Systems	110
G3	Qualitative Assessment of Current Situation and Future Aims by Organic Pig Farmers	111
G4	Does Animal Health and Welfare of Organic Pigs Differ between Husbandry Systems?	112

Theme	Poster Titel	
H: EDUCATION AND MARKET DRIVEN ANIMAL WELFARE		
H1	Integrating Pig Welfare Outcomes into Farm Assurance Schemes	113
H2	DANISH Product Standard	114
H3	The Profile of Italian Consumers of Animal-Friendly Foods	115
H4	Master Education in the Assessment of Farm Animal Welfare - a Recent Danish Initiative	116
H5	A Review of Enrichment Provision in the European Supply Base of a Major UK Retailer: Analysis of Compliance Trends Following the Introduction of Agricultural Code of Practice Requirements.	117
I: TRANSPORT		
I1	Preliminary Study of Non-Compliance with Animal Welfare Legislation when Transporting Pigs in Sweden	118
J: SLAUGHTER LESIONS		
J1	Validation On-Line Slaughter Checks as a Pig Welfare Diagnostic Tool	119
J2	A Comparison of Lesions Found During Meat Inspection of Finishing Pigs Raised under Organic/Free-Range Conditions and Conventional Indoor Conditions	120
J3	Shoulder Lesions in Norwegian Sows at Slaughter	121
K: BEHAVIOUR OF PIGS		
K1	Female and Male Pigs' Performance in a Judgment Bias Task	122
K2	Female Pigs Do Not Get Bullied when Penned Together with Entire Male Pigs During the Fattening Period	123
K3	Startling Pigs - a Potential Welfare Measure	124
K4	Measuring Coping Style on a Continuous Scale and Its Relation to Aggression at Mixing in Weaned Pigs	125
K5	What are You Looking At: Differences and Similarities Between Stakeholders in Assessing Pigs	126
K6	How to Solve a Conflict Without Getting into a Fight	127
L: DISEASES, TREATMENT AND PREVENTION		
L1	Effect of Removal of In-Feed Antibiotics on Skin Lesion Scores of Pigs During the 1 st and 2 nd Weaning Stages	128
L2	A Welfare-Friendly Sampling Method for Group-Housed Gestating Sows	129
L3	The Pig Appeasing Pheromone: How Chemical Communication Improve the Welfare of Pigs	130
L4	Potential Use of Phytoterapy to Reduce the Stress in Pigs.	131
L5	Efficacy of an Anti-GnRF Vaccine in Suppressing Estrus in Iberian Gilts	132
L6	Stomach Ulcers in Lactating Sows are Not Associated with Low Feed Intake	133
L7	A Cross-Sectional Study on the Prevalence and Risk Factors for Limb Lesions and Lameness in Finisher Pigs on Commercial Farms in Ireland	134
M: MANAGEMENT		
M1	The Ergonomy of Breeding: an Innovative Approach to Improve Welfare in Pig Production	135



EFFECT OF A RUBBER TOP LAYER ON CONCRETE FLOORS ON GAIT SCORE IN GROUP HOUSED SOWS

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Lameness in sows is a major welfare and production problem. Social interactions and increased activity and appear to elevate the risk for lameness when gestating sows are group-housed on inadequate floorings. In intensive production units, sows are usually housed on bare concrete floors. Although bedding is known to provide better floor comfort it is not commonly provided. The present experiment investigated therefore the effect of a rubber top layer on both the slatted and unslatted areas of the pens' floor compared to conventional concrete floors on sows' gait.

We observed six groups of 20 hybrid sows each, during three consecutive reproductive cycles. The housing conditions during lactation and shortly after weaning were identical for all groups. From four weeks after insemination until one week before parturition three groups were housed in pens with concrete floors (40.3m² slatted and 31.7m² solid), and three groups in identical pens but with a rubber top layer fitted to all slatted and half the solid floor. Gait score was performed using a 150mm tagged visual analogue scale (tVAS), five times per cycle: before grouping, three days after grouping, mid- gestation, end of gestation, and end of lactation. A gait score ≥ 60 mm is considered lame. The data were analysed using a linear mixed model with floor treatment and reproductive phase as fixed effects and cycle, group and sow as random effects.

For both floor types the prevalence of lameness increased during gestation and decreases during lactation. So, a rubber layer does not eliminate the risk of developing lameness at the beginning of the gestation period ($P=0.15$). The sows' gait was better at the end of the gestation phase when housed on rubber-topped floors (difference: $9.88\text{mm} \pm 4.12$ on 150mm tVAS, $P=0.01$). A rubber topped-floor does seem to increase the likelihood of healing lameness.

CONFINEMENT BEFORE FARROWING AFFECTS THE PERFORMANCE OF NEST BUILDING BEHAVIOURS BUT NOT THE PROGRESS OF PARTURITION

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The effects of confinement prior to farrowing on the performance of nest building behaviours and progress of parturition were investigated using Danbred hybrid sows. Forty first parity and 40 second/third parity sows were either loose housed in a freedom farrowing pen or confined by crating within the same pen from 2 days before expected farrowing until the birth of the last piglet. All sows had access to a straw rack that was filled up daily with long straw. Sow behaviours and postures were obtained continuously during the last 24 hours before parturition from video recordings. In addition, the time of birth of every piglet was registered, and it was noted if the piglet was alive or stillborn. The results showed that confinement did not influence the duration of the nest building period, but it affected the performance of nest building behaviours. Loose housed sows tended to perform more nest building behaviours during the nest building period than confined sows (817 vs. 687 s/h/sow, $P=0.08$). Loose housed sows had fewer bouts of nest building behaviours than confined sows (4.6 vs. 6.1 bout/sow/h, $P=0.03$) but mean duration of the bouts was longer (154 vs. 99 s/bout, $P<0.001$). Loose housed sows tended to spend a greater proportion of time during the nest building period standing/walking (21 vs. 17 min/h, $P=0.05$). No differences were found in the duration of farrowing, birth durations, birth intervals or percentage of stillborn piglets. In conclusion, confining the sows during nest building and farrowing decreased the performance of nest building behaviours, but confinement did not prolong the progress of parturition compared to loose housed sows in this prolific breed.

EFFECTS OF TEMPORARY CONFINEMENT OF SOWS FOR 4 DAYS AFTER FARROWING ON SOW BEHAVIOUR AND SALIVA CORTISOL

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This study aimed at investigating if confinement for 4 days after farrowing influenced sow behaviour and increased saliva cortisol levels. The study was conducted in a Danish piggery with SWAP (Sow Welfare And Piglet protection) farrowing pens. Sows were randomly allocated to one of three treatments: Loose-loose (LL: loose from placement in the farrowing unit to weaning; n=48), loose-confined (LC: loose from entry to end of farrowing and confined to day 4 post farrowing; n=50), and confined-confined (CC: confined from day 114 of gestation to day 4 post farrowing; n=45). All sows were loose housed from day 4 to weaning. Behavioural registrations were obtained from video recordings and saliva samples were collected daily. Sow behaviour was characterised by few postural changes and prolonged lateral lying in all treatments. Postural changes increased during the day in all treatments but more so in LL than LC and CC ($P=0.02$). Sows in LL had higher frequencies of getting up and lying down ($P<0.05$). Rolling frequency increased from day 1 to day 3 post farrowing in all treatments, but LL had a greater increase than LC and CC ($P<0.001$). Time spent lying lateral was similar across treatments ($P=0.66$). Sows in LL had more nursings than LC and CC on day 1 ($P<0.001$) and more nursings than CC day 2 ($P=0.04$) and day 3 ($P=0.01$). Sows in LL terminated more nursings than LC and CC on day 3 ($P\leq 0.001$). Saliva cortisol concentration was higher in LL than in LC day -1, 1 and 2 ($P<0.05$) and higher than CC from day -1 to day 3 ($P<0.01$). In conclusion, the results suggested that confinement for 4 days after farrowing had little influence on sow behaviour. Cortisol concentrations did not reflect behavioural differences but cortisol response was decreased if sows were confined before farrowing.

CONFINED AND LOOSE HOUSED SOWS HAD SIMILAR DURATION OF FARROWING

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Confinement of sows in farrowing crates limits the ability of sows to perform nest-building behaviour. The stress-inducing aspects of this restriction might adversely affect the process of parturition, resulting in prolonged farrowing and longer birth intervals. The aim of this study was to investigate if confinement before and during farrowing increased farrowing duration and birth intervals. Danish Landrace x Yorkshire sows from a commercial herd were allocated to one of two treatments; crated (C, n=62) or loose (L, n=58) before and during parturition. All farrowings were video recorded and data was analysed using linear models. Sows had a mean parity of 3.5 ± 0.2 and gave birth to 17.9 ± 0.5 piglets per litter. Mean farrowing duration from birth of first piglet (BFP) to birth of last piglet was 462 minutes (95% CI: 381; 552) for C-sows and 394 minutes (95% CI: 316; 483) for L-sows ($P=0.26$). Mean duration from BFP to birth of last live born piglet was 413 minutes (95% CI: 345; 486) for C-sows and 352 minutes (95% CI: 287; 424) for L-sows ($P=0.22$). Older sows (parity 3+) had longer duration of farrowing than younger sows (parity 1-2) ($P<0.001$). Mean birth duration, calculated as time from BFP to birth of the nth piglet, was 259 minutes (95% CI: 228; 293) for piglets born by C-sows and 220 minutes (95% CI: 190; 252) for piglets born by L-sows ($P=0.09$). Mean birth interval was 23 minutes (95% CI: 20; 26) for piglets born by C-sows and 26 minutes (95% CI: 18; 24) for piglets born by L-sows ($P=0.25$). Birth interval was, shorter for live born piglets (15 minutes (95% CI: 14; 17)) compared to stillborn piglets (30 minutes (95% CI: 24; 35)) ($P<0.001$). In conclusion confining the sows in crates before farrowing did not affect the progress of parturition in this prolific breed.

BEHAVIOUR AND PRODUCTION TRAITS OF ITALIAN HEAVY PIGS AS AFFECTED BY TWO FLOOR SPACE ALLOWANCES

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It is widely recognized that the welfare of pigs can be compromised by severe restrictions of space. According to Directive 2008/120/EC, the minimal floor space allowance for pigs over 110 kg BW (Body Weight) is 1 m²/head, but no further provision is made for heavier animals such as Italian heavy pigs, whose weight at the end of the production cycle is of 160 kg or more. The aim of the present trial was to investigate the effects of two different space allowances on the main behavioural and production traits of Italian heavy pigs.

Sixty barrows (initial average BW: 23.9 kg) were used. Animals were kept in small groups (5 pigs/pen). Thirty pigs were given an individual floor space allowance of 1 m²/head (in compliance with European legislation), whereas 30 pigs were given a floor space allowance of 1.3 m²/head. Rearing conditions, management and feeding were identical between the experimental groups. Animals were weekly videotaped and behaviours were assessed by scan-sampling. Growth parameters (ADG=average daily gain and FCR=Food conversion ratio) were collected and pigs were slaughtered at the average BW of 160 kg to assess carcass and meat quality.

From our results it is concluded that animals kept at 1.3 m²/head had better productive parameters, showing higher BW at slaughter ($P<0.02$), higher ADG ($P<0.01$) and lower FCR ($P<0.01$) than control pigs. Behavioural differences were observed, with pigs kept at higher space allowances spending significantly more time in lateral recumbency ($P<0.001$) and less time exploring/pseudo-rooting the pen ($P<0.001$), with an overall increase in time spent resting ($P<0.01$) when compared to the control group. No differences were observed in carcass and meat quality. In conclusion, the adoption of higher space allowances can not only be beneficial to swine welfare allowing animals to rest more comfortably, but also improve their productive parameters.

IMPROVING SOW FERTILITY AND PRODUCTION BY GROUP HOUSING MANAGEMENT TOWARDS BETTER ANIMAL WELFARE

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Improving animals' welfare may potentially enhance swine farms economics. The pig industry is based on high reproductive productivity, which can be evaluated by parameters such as rate of sows returning to estrus after insemination (return rate) and litter size. In Israel, until 2013, most sows were housed in individual confinement stalls throughout all breeding and pregnancy periods. During 2013, group housing management, from approximately 28d post-insemination until few days prior to parturition, was gradually employed. Our objective was to examine the production and reproduction parameters of sows in group housing management during pregnancy (either 30 or 7 sows per group) as compared to conventional individual housing management (Control), in a large commercial pig farm under Israeli conditions. Most analyses included data from 603 sow cycles (parity 3-8; mix breed of Landrace, Large-White, and Pietrain). Sows were allocated to either a 'Large' (LG: n=246) or a 'Small' group (SG: n=87) at approximately 28d post-insemination. As control, historical sows data (n=270; Year 2012) were randomly matched based on parity and parallel insemination date. For the analysis of return rate, data from 1713 control sow cycles (parity 3-8; 2012) were included. Differences among groups were analyzed by General-ANOVA (controlled for parity and breeding month), or Pearson chi-square. Body condition in group housing management improved over gestation period. Return rates in group housing management were significantly lower as compared to control (LG:45/256, 18.3%; SG:18/87, 20.7%; Control:573/1713, 33.5%, $P<0.02$). Mean cycle length (weaning-to-weaning) was significantly shorter in group housing management (mean \pm SEM; LG:143.4 \pm 0.9d; SG:141.2 \pm 1.1d; Control:149.8 \pm 1.9d; $P<0.01$), but there were no differences in gestation lengths (LG:114.3 \pm 0.1d; SG:114.4 \pm 0.1d; Control:114.6 \pm 0.1d). Overall, in group housing management there was a tendency for higher number of total piglets born (LG:13.2 \pm 0.2; SG:13.3 \pm 0.4d; Control:12.75 \pm 0.2; $P=0.1033$), as well as a tendency for higher piglets born alive (LG:11.8 \pm 0.2; SG:12.1 \pm 0.4d; Control:11.4 \pm 0.2; $P=0.0862$). Our results support the conclusion that group housing management can potentially enhance reproduction and productivity in pregnant sows.

THE USE OF THE WELFARE QUALITY® PROTOCOL TO COMPARE THE WELFARE OF PIGS SUBJECTED TO TWO DIFFERENT HOUSING CONDITIONS

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The aim of the study was to assess the effect of the housing conditions on the welfare of pigs using some criteria of the Welfare Quality® protocol.

A total of 44 female pigs aged 8 weeks coming from the same farm were allocated in four pens. During the first 7 weeks, pigs were allocated under the same housing conditions (fully slatted floor with a density of 1.2m²/pig). The following 7 weeks, the density was reduced to 0.7m²/pig in two pens (barren), whereas in the other two pens the density was maintained, the floor change to concrete and 700g of straw/pig were provided every 2-3 days (enriched). Three Welfare Quality assessments (WQ) were performed; the first one was performed before implementing the new housing conditions, and the second and third after 3 and 7 weeks, respectively. The criteria assessed were comfort around resting, injuries, social and exploratory behaviour and positive emotional state. Statistical analyses were performed with SAS using the MIXED or GENMOD procedure according to the normality of the data.

No differences were found regarding comfort around resting and social behaviour. The barren group had a higher number of injuries ($p=0.08$) during the third WQ possibly due to the fights caused by space allowance. The exploratory behaviour was higher ($p=0.09$) for the enriched group during the second WQ but not during the third, suggesting that straw promotes exploratory behaviour during the first days but then decrease. Finally positive emotional state was higher in the enriched group in the second ($p<0.05$) and the third WQ ($p=0.06$), suggesting that lower density, concrete floor and presence of straw could have a positive effect on this parameter.

These results suggest that housing conditions studied have an effect on the welfare of pigs and the WQ criteria used are a valid tool to assess it.

EFFECT OF THERMAL STRESS, TYPE OF FLOOR AND NUMBER OF FEEDERS IN GROWING PIGS: PRELIMINARY RESULTS

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In a situation of stress some body functions, such as growth and immune response are left in a secondary level, which have welfare, health and productive consequences. After a 7-day acclimation period, 256 Large White x Landrace x Pietran pigs were housed under two temperature regimes (comfort: with 20-25° and thermal stress: with 6 hours a day close to 30°) to ascertain the effect of moderate thermal stress on growth rate and immune system in growing pigs. In addition, the effect of the type of floor (30% slat or 100% slat) and the strategy to have one feeder (8 pigs per feeder) or two feeders (4 pigs per feeder) in each pen was also tested. Even in the case of a moderate thermal stress, pigs in the control room had higher ($P<0.01$) body weights at the end of the study than pigs under stress conditions (109 ± 9.6 and 101 ± 9.0 kg, respectively). In addition, pigs reared with 30% slat had higher ($P=0.03$) body weights than pigs reared with 100% slat (106 ± 9.4 and 104 ± 9.3 kg, respectively) and pigs with one feeder had higher body weights ($P=0.02$) than pigs with two feeders (109 ± 9.6 and 101 ± 9.0 kg, respectively). No effect was found for immune system when stress and comfort rooms were compared. However, animals reared in 100% slat showed higher ($P<0.01$) counts of leucocytes and lymphocytes than animals reared in 30% slat. Finally, the ratio lymphocytes/neutrophils was higher ($P<0.01$) in pens with two feeder than pens with one (2.3 ± 0.37 and 1.9 ± 0.12 , respectively), showing an increase of stress in the second case. Results show an effect of moderate thermal stress, floor condition and number of feeders on final body weight of pigs with some effects on the immune system in relation to a major competition for food and floor type.

TEMPORARY CONFINEMENT OF SOWS IN SWAP FARROWING PENS FOR 4 DAYS REDUCES PIGLET MORTALITY

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Commercial viability of loose housed farrowing systems is challenged by risk of increased piglet mortality. The objective of this study was to investigate if short-term confinement around farrowing in a farrowing pen where sows could be confined temporarily (SWAP=Sow Welfare And Piglet protection) would decrease piglet mortality compared to loose housed sows. The study was conducted in a Danish piggery where records were obtained from 2,139 farrowings. Sows were randomly allocated to one of three treatments: Loose-Loose (LL), Loose-Confined (LC) and Confined-Confined (CC). In LL, sows were loose housed from placement in the farrowing pens to weaning. In LC, sows were loose housed until farrowing was finished and then confined to day 4 after farrowing. In CC, sows were confined at day 114 of gestation to day 4 after farrowing. All sows were loose housed from day 5 to weaning. Data were analysed using linear models. Total piglet mortality was greater in LL (26.0%) and LC (25.4%) compared to CC (22.1%) ($P<0.001$). A larger proportion of total born piglets was crushed in LL (10.7%) compared to LC (9.7%; $P=0.03$), which was greater than CC (7.8%; $P<0.001$). Piglet mortality before litter equalization was higher in LL (7.5%) and LC (7.0%) than in CC (3.7%) ($P<0.001$). Confinement reduced piglet mortality from litter equalization to day 4 (LL: 7.6% vs. LC: 6.7%; $P=0.01$), but more so in CC (5.6%) than in LC ($P<0.001$). From day 4 to weaning LL had lower mortality (5.6%) than LC (6.9%) and CC (6.6%) ($P=0.01$). The results emphasize that the period of time from the birth of the first piglet to litter equalization is important in relation to piglet mortality. Results also suggest that confinement for 4 days after farrowing can reduce mortality in this period, but confinement from before farrowing was necessary to reduce total piglet mortality.

B1 NURSING SOWS

NURSE SOWS FOR SUPER NUMEROUS PIGLETS

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Background: Piglets form a rank to have access to their own milk gland. When sow has too few glands for the piglets, surplus piglets lacks access to milk.

Objective: Investigate the best way of nursing super numerous piglets.

Relevance: Lack of energy (mothers milk) is the most frequent cause of death in piglets.

Material and Methods: In four comparative studies, super numerous piglets were collected and randomly allotted to paired nurse sows. Paired nurse sows were randomly allotted to two treatments in each study answering: Young or old nurse sows? One or two-step nurse sows? Injection of oxytocin at nursing? Is growth and survival affected in nurse piglets? Is fertility in the subsequent parity affected in nurse sows?

Results: Piglets allotted to 1st parity nurse sows had significantly higher survival rate than piglets allotted to older nurse sows. Nurse piglets allotted to two-step nurse sows had significantly higher survival rate and growth than when allotted to one-step nurse sows. Oxytocin injection gave a non-significant decrease in weaning weight. Nurse piglets at a two-step nurse of 1st or 2nd parity had the same survival and weaning weight, as with the mother. A nurse sow introduced 4 to 7 days after farrowing had the same fertility as other sows in respect to fertility. A nurse sow introduced > 20 days after farrowing, had a significantly lower farrowing rate but farrowed significantly more piglets in next litter (17.1 piglets born versus 15.1 piglets in control sows).

Conclusions: Super numerous piglets achieve a normal growth and survival rate, if transferred to nurse sows which are young two step nurse sows. Nurse sows had higher litter size in the subsequent parity, but a lower farrowing rate.

FARM SURVEY: NURSE SOWS' REPRODUCTIVE PERFORMANCE IN THE SUBSEQUENT LITTER

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The use of nurse sows in Danish herds is common practice due to the large litter sizes; however, the effect of being selected as a nurse sow on welfare and subsequent reproductive performance is unknown. Therefore, the aim of this farm survey was to quantify a nurse sow's reproductive performance in the subsequent litter. Nurse sows (NSOWS) were defined as sows weaning their own litter at least 21 days post-partum and thereafter nursing another litter (nurse litter) prior to service. Data (2012-2013) from 20 herds with more than 14.5 live born piglets per litter and a stable distribution of sows among parities over time were selected. Results from 79,868 litters were analyzed using the mixed procedure of SAS. Herd and the interaction herd×year×month were included as random effects, while parity and season were included as fixed effects. The average lactation were 40.5 and 27.4 days ($P<0.001$) for NSOWS and ordinary sows (OSOWS), respectively. Nurse sows weaned on average 12.4 piglets and subsequently 11.5 nurse piglets, whereas OSOWS weaned fewer piglets ($P<0.001$) in their single weaning (11.6). There was no difference in rate of sows returning to heat in the subsequent reproductive cycle between NSOWS and OSOWS ($P=0.90$). Subsequent litter size in the next reproductive cycle was higher ($P<0.001$) for NSOWS (18.7 total born piglets) than for OSOWS (18.1 total born piglets). Results indicate that nurse sows were selected among sows nursing large litters, and could therefore indicate that these sows represented the best percentile of sows in a given herd. In conclusion, this survey indicated no negative effects of being selected as a nurse sow on the subsequent reproductive performance. On the contrary, nurse sows gave birth to more piglets compared to ordinary sows.

SALIVA CORTISOL LEVELS OF NURSE SOWS AND ORDINARY SOWS THROUGH LACTATION

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Nurse sows are used in piggeries with hyper-prolific sows to manage large litters. It is, however, not known if nurse sows experience prolonged stress by having to stay in farrowing crates beyond the normal weaning time. Therefore our aim was to quantify the long-term saliva cortisol response as a measurement of the nurse sows stress level compared to ordinary sows (OSOW) weaning piglets at d25. In Denmark, cascade fostering using two lactating sows are normally performed. The first nurse sow (NURSE1) has her own piglets removed after a week and receives surplus newborn piglets that she fosters until weaning. The second nurse sow (NURSE2) weans her own litter after 21 days and receives the litter from NURSE1 which she rears until weaning. In total 60 sows (n=20) were randomly allocated to become an OSOW, NURSE1 or NURSE2. Saliva was collected on d6, 13, 20 and 24 at 10h, 13h and 16h for all sows. Additional samples were taken on d31 for NURSE1 and NURSE2 and d38 for NURSE2. Saliva samples were analysed using a Salivary Cortisol kit (Salimetrics, UK). Cortisol data were log transformed and analysed univariately using proc mixed in SAS. Results showed that there was no effect of treatment but an effect of day ($P<0.001$) with saliva cortisol declining throughout lactation with values of 19.9, 17.1, 12.8 and 10.4nmol/l (back transformed values) at d6, 13, 20 and 24, respectively. NURSE1 tended to have lower values (8.3nmol/l) on d31 than on d24 (11.5nmol/l; $P=0.08$). NURSE2 had lower cortisol values on d38 (7.4nmol/l) and on d31 (7.5nmol/l) than on d24 (11.1nmol/l; $P<0.05$). Results indicate that saliva cortisol levels decline throughout lactation and there was no difference in saliva cortisol levels between OSOWS and nurse sows. In conclusion, saliva cortisol levels indicate no additional long-term stress of being used as a nurse sow.

THE EFFECT OF PEN DENSITY ON PIGLET WELFARE AND GROWTH

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Maximal pen densities are prescribed by law, but laws are not consistent between different European countries although it is known that pen density may have a great impact on production results. The objective of the study was to investigate if pen density has an impact on piglet welfare as well as piglet growth. Different pen densities were tested in the weaner unit where piglets stayed until they reached a weight of 20 kg: high density (0.24 m²/animal) vs low density (0.29 m²/animal). The legally required space for piglets until 20 kg in Belgium is 0.20 m². When moved to the finishing accommodation, a density of 0.69 m² per animal was maintained in all pens, while the legally required space for fattening pigs until 110 kg in Belgium is 0.65 m². Piglets were weighed when entering and leaving the weaner unit and at the end of the fattening phase. Behavioral observations were carried out and lesions were scored. Results show that behavior, growth as well as lesions at the end of the piglet phase were influenced by pen density. The lower pen density gave the best results: less frustration behavior, less lesions and a higher average daily gain. Feed conversion ratio was not affected. In the fattening phase, when all pens had the same density, the differences originated in the weaner unit disappeared. As a conclusion, pig welfare and production results can benefit from lower pen densities. However, it must be investigated if a better growth can compensate for the fewer pigs that are being set up. A balance should be found between optimal pen density and optimal economical results.

DOES LITTER SIZE AFFECT EMOTIONAL REACTIVITY, SPATIAL LEARNING AND MEMORY IN PIGLETS?

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In the pig industry, average litter size has steadily increased over the past decades. Large litters are associated with an increase of piglets born with a low birth weight and reduced overall piglet viability. The aim of this study was to investigate whether litter size affects emotionality and cognition in pigs. Ten piglets from relatively large litters (≥ 18) were compared with ten piglets from relatively small litters (≤ 13). Piglets from two batches were used, each batch from a different breeder, and transported to the research facility at 4 weeks of age. Emotionality of the piglets was assessed in a combined open field and novel object test at 5 weeks of age. Spatial learning and memory was assessed using the spatial cognitive holeboard task when the pigs were between 9 and 14 weeks old. Litter size neither affected activity scores in the open field test and the reaction to the novel object, nor did it affect the increase of salivary cortisol in response to open field testing. No effects of litter size were found on spatial learning and memory. Interestingly, however, the pigs originating from one of the suppliers – known for their high health standards and greater robustness – showed a smaller increase in salivary cortisol after the combined open field and novel object test, more uniformity in growth over the course of the experiment, and a better reference memory performance during the acquisition of the holeboard task than the more standardly bred pigs originating from the other supplier. From our results, we tentatively conclude that pigs from a more robust genetic line show less stress sensitivity and seem to be less affected by factors such as stress, which may interfere with the performance in cognitive tasks. This notion, however, should be tested and confirmed in a larger scale study.

HIGHER PIGLET MORTALITY IN DESIGNED FARROWING PENS COMPARED WITH TRADITIONAL FARROWING CRATES

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Loose housed systems for farrowing and lactating sows can only be considered a realistic alternative to farrowing crates if equal or better production results can be obtained. The aim of this study was to compare piglet mortality in Free Farrowing pens (FF-pens) and farrowing crates in commercial pig farms. The study was conducted in three commercial herds (A, B, and C) that had farrowing crates and FF-pens in their farrowing units. Data from 1416 Danish Landrace x Danish Yorkshire sows and their litters were collected. Piglet mortality was analysed by use of linear models in two periods: before litter equalisation and after litter equalisation. Piglet mortality before litter equalisation was higher in FF-pens (13.7%) than in crates (11.8%) ($P<0.001$). Piglet mortality after equalisation was higher in pens than in crates, but the difference was dissimilar in the three herds ($P<0.05$). Piglet mortality increased with increasing parity before ($P<0.001$) as well as after ($P<0.001$) litter equalisation. More total born piglets increased mortality before equalisation ($P<0.001$) and a larger equalised litter size increased mortality after equalisation ($P<0.001$). The proportion of sows with high mortality ($>11\%$) before litter equalisation was greater in pens than in crates in herd B (66% vs. 52%; $P=0.01$), but not in herd A (58% vs. 47%; $P=0.11$) and herd C (45% vs. 44%; $P=0.77$). The proportion of sows with high mortality after equalisation was greater in pens compared with crates in herd A (77% vs. 62%; $P=0.01$) and herd B (74% vs. 51%; $P<0.001$) but no difference was seen in herd C (52% vs. 46%; $P=0.18$). In conclusion, the results showed that piglet mortality was higher in FF-pens compared with traditional crates. Some sows were able to deliver acceptable piglet mortality levels, but the proportion was too small to consider FF-pens a robust type of housing.

RECOVERY FROM INTRAUTERINE GROWTH RESTRICTION IN PIGLETS DEFINED BY THEIR HEADSHAPE: A PILOT STUDY

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Large litters due to hyper-prolific sows have increased the amount of piglets born small and with signs of intrauterine growth restriction (IUGR). These piglets have an increased risk of dying and have lower liver glycogen and glucose levels at 24 hours after birth. Piglets that have suffered from IUGR have a dolphin-like headshape (due to brain sparing) at birth but this headshape is not observed at weaning, suggesting that they either die or lose the dolphin-like headshape. The aim of this study was to investigate 1) if piglets with severe signs of IUGR can survive, and 2) at what age and body weight (BW) surviving IUGR piglets obtain a normal headshape. A total of 370 piglets born to DanBred hybrid sows were classified as either "normal", "mildly IUGR" (m-IUGR) or "severe IUGR" (s-IUGR) based on the head morphology at birth and re-scored after one and two weeks. Data was analysed univariately in proc mixed in SAS. Results showed that at birth 218 piglets were deemed "normal" (BW 1.6kg), 138 piglets were m-IUGR (BW 1.2kg) and 14 piglets were s-IUGR (BW 0.8kg). After one week all the piglets given an s-IUGR score were still alive and were re-scored as m-IUGR. In total 314 piglets were re-scored as normal (BW 2.7kg) and 56 piglets given an m-IUGR score (BW 1.7kg). Of these 56 piglets 42 had also been scored m-IUGR at birth. After two weeks all piglets were re-scored as normal with an average BW of 3.9kg. IUGR score at birth furthermore influenced weight gain from 0 to 14 days ($P < 0.001$). The results suggest that if an IUGR piglet can reach approx. 2kg BW the dolphin-like headshape seems to disappear, however, daily gain at least up to d 14 is still influenced by their headshape at birth.

SUPPLEMENTARY MILK DURING LACTATION IMPROVES PIGLET SURVIVAL

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The survival rate of live born piglets in Denmark is 86.3 %. An increase in survival rate is of great relevance to both welfare and economy. Access to supplementary milk can improve equal energy intake among litter mates and is expected to reduce not only mortality, but also the need for nurse sows and redistribution of piglets.

The study investigated whether free access to supplementary milk reduced piglet mortality in litters standardized to 14 piglets.

Nineteen control litters and 21 litters offered continued access to supplementary milk (" +milk") were standardized to 14 piglets within the first app. 12 hours after birth. Piglets lighter than 800 grams were excluded. The group " +milk" had free access to milk cups and milk substitute from Provimi. In order to avoid effect of batch, the app. 20 litters per group were equally distributed between four weekly batches.

The study was a preliminary study and the data were reported as averages. Similar results were achieved in all four consecutive weeks of farrowings indicating that the result was valid. The results showed that piglet survival in the " +milk" groups increased from 90 to 95 % from the time of standardization of litter size to weaning. Furthermore, the percentage of runt piglets removed was reduced from 7 to 5 %. On average 13 piglets were weaned per litter in the " +milk" group versus 12 piglets in the control group.

One additional piglet was weaned in litters with free access to supplementary milk. Access to supplementary milk may be part of the solution in the pursuit of higher piglet survival rate and increased welfare on-farm.

POTENTIAL RISK FACTORS FOR PIGLET MORTALITY IN DANISH ORGANIC PIG PRODUCTION

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Piglet mortality in Danish organic pig production is very high. In a previous study with on-farm mortality registrations the total piglet mortality until weaning (including stillborn piglets) was estimated to be 33%. The proportion of true still born piglets was estimated to be 9%. The high piglet mortality is seen as a key constraint for organic pig production in achieving its potential importance, since consumers expect a high level of animal welfare in organic livestock production. The aim of this study is to identify the major risk factors for piglet mortality in Danish organic pig production. Herd level risk factors as well as sow level risk factors (parity, health status, nursing sows, litter size and piglet birth weight) and their interaction with season will be investigated. Detailed registrations of number of total born, dead and weaned piglets as well as parity, body condition, health status of the sows and number of cross fostered piglets will be carried out in nine medium-large Danish organic pig herds from June 2014 until June 2015. The piglet mortality registrations are expected to include approximately. 6000 farrowing's. Necropsies are being performed to establish the cause of death and the true proportion of stillborn on a random sample of piglets from each farm in all seasons. In total necropsies will be conducted on approximately 4000 piglets.

NEONATAL MORTALITY IN PIGLETS IS MORE DUE TO LACK OF ENERGY THAN LACK OF IMMUNOGLOBULINS

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Background: Colostrum is important for new born piglets, as they are born without protective immunoglobulins (IgG) and with very low energy reserves.

Objectives: This study differentiates the effect of colostral IgG and energy on piglet survival.

Relevance: Piglet mortality is highest in the first days of life

Materials and methods: In one farm, 27 DanAvl hybrid sows farrowed 16.9 (7-24) live born piglets per litter. All piglets were ear tagged and weighed within 15 minutes of birth. Every second piglet was used in another study, so this investigation included 221 piglets. All piglets stayed with their own mother sow for 24 hours, where they were bled to test serum for maternal derived IgG. After this litter size was adjusted. All piglets remained in the study until 21 days of age. Piglets dying during lactation were subjected to necropsy.

Summary: Piglet survival was 90.5%. 21 piglets died between 0 and 12 days after birth. Four piglets died before the test for IgG. Of the 17 remaining piglets, five piglets had serum IgG below 10 mg/ml. The remaining 12 piglets had acceptable IgG-levels, but 10 had empty or nearly empty stomachs, while one piglet had a full stomach and one was not necropsied.

Conclusion: Solutions to increase survival should focus on energy intake, as most dead piglets had received IgG but had empty stomachs.

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A SOLUTION FOR HIGH PRODUCTION NUMBERS IN FARROWING UNITS?

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In today's pig husbandry, farmers strive for large litters and high production numbers. However, it is often forgotten that the average birth weight decreases when litters are larger. This can affect growth, mortality rate, feed conversion ratio... Because sows sometimes have more piglets than they can nurse, piglets can be raised in piglet nurseries or by 'foster sows'. The objective of the present study was therefore to compare production results (growth and mortality rate) of piglets with the mother sow, piglets raised by a foster sow and piglets in a rescue deck. Results indicate that all three groups of piglets have similar average daily gain (ADG) during the first two weeks of life. However, during the third and fourth week piglets in rescue decks have a higher ADG than the other groups. This is probably due to the fact that piglets in rescue decks had ad libitum access to milk, while the other piglets were limited by the milk producing capacity of the (mother or foster) sow. After weaning, when all piglets have ad libitum access to feed, the difference in ADG disappears again. There were no differences in mortality rate. As a conclusion, rescue decks can give an advantage in ADG to piglets, but the advantage is temporary and disappears after weaning.

BIOACTIVE COMPOUNDS – THE FUTURE ALTERNATIVE TO CASTRATION TO PREVENT BOAR TAIN?

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Today's solution to the problem of skatole accumulation in pork meat is castration of male piglets. High skatole concentration is associated with off-flavour and off-taste of the meat and is of great importance for the consumer's perception of the meat. The phenomenon is mainly associated with sexual mature males and is known as boar taint. Skatole is metabolised in the liver of the pig; hence insufficient hepatic skatole metabolism results in skatole accumulation. From an animal welfare point of view, it is desirable to find ways to enhance hepatic skatole clearance using an easy, non-drug-based method – as an alternative to castration. One suggestion is the use of bioactive compounds upregulating the hepatic activity of CYP450 (family of enzyme responsible for skatole metabolism).

In a series of experiments conducted using porcine hepatocytes, we have identified bioactive compounds presents in e.g. the roots of chicory which can improve the ability of the liver to metabolise skatole. Isolated hepatocytes from piglets were exposed to pure secondary metabolites, like artemisinin, scoparone and lactucin, in different concentrations for 24 hours. Following treatment, the mRNA expression of several CYP450 isoforms of relevance to skatole metabolism was analysed using RT-PCR. The analysis showed that the treatment could up-regulate the expression of CYP450s by several folds. This suggests that selected bioactive compounds from plants could potentially be used as part of a feeding regime to enhance the hepatic clearance of skatole and thereby be an alternative to castration as the solution to boar taint.

POSSIBLE FUTURE PRODUCTION OF MALE PIGS IN DK

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Large-scale production of male pigs in Denmark is possible if:

- rejection rates due to boar taint is maximum 5%,
- a cheap on-line analysis method for skatole and androstenone is available
- analysis methods and limits for rejection are accepted internationally.

However reaching a rejection rate below 5% can be difficult.

Screening of 9 farms delivering min. 50 male pigs each showed that if future rejection is based on either human nose or skatole in combination with androstenone, production of male pigs will not be profitable. 2% were rejected due to skatole equivalents >0.25ppm, 11% were rejected due to human nose test (at line) and 37% were above 1.00 ppm androstenone. Screening of male pigs from 6 organic farms showed economically unrealistic high rejection rates (68% based on skatole eq. > 0,25ppm and androstenone >1,00ppm).

Effect on Skatole

Recent research shows that skatole in fat could be lowered through feeding. Feeding either pure grain or 15% chicory or 10% Jerusalem artichoke for 4 days reduces the skatole level in fat by 20-25%. No effect of including 15% palm cake or lupines in the diet was found. Carcass weight (75 or 95 kg) did not affect the skatole level.

Effect on Androstenone

Feeding has no effect on the level of androstenone in fat. However, an increase in carcass weight from 75 to 95 kg increased the level of androstenone by 38%. The percentage of male pigs above 1.00 ppm androstenone rose by 18%.

Results from a trial where biopsies were taken from 60 kg till 120 kg in 10 kg intervals showed a linear increase in androstenone and a good correlation of androstenone at 60 kg and at 120 kg, which gives an opportunity to detect male pigs with boar taint at an early stage or possibly settle a maximum weight.

D3 CASTRATION AND PRODUCTION OF ENTIRE MALE PIGS

CONSUMER ACCEPTANCE OF MEAT FROM MALE PIGS NOT SURGICALLY CASTRATED

Gé Backus, Wageningen UR

Consumer acceptance in the EU and in 3rd countries of meat was studied. The relationship between androstenone and skatole levels and the sensory assessment of meat obtained from male pigs is established. Consumer attitudes towards acceptance factors of alternatives of surgical castration of pigs are assessed.

Sensory tests are conducted with 1.099 consumers in 7 countries. Increasing levels of skatole are related to a decreasing preference for boar over castrate meat. Increasing levels of androstenone are only in the low skatole range related to decreasing preference for the boar meat.

An online survey among 11.294 consumers is conducted in ten EU and four 3rd countries. Four dimensions of motives are identified that determine the attitude of consumers related to the production of pork. Consumers in all countries perceived food safety and quality on average as most important. Animal and environmental friendliness is rated second in ten countries; third in two countries, and fourth in Latvia. Price and regional identity are the other dimensions of pork-production related motives for consumers. When respondents are asked to choose three main motives for buying and eating meat; Quality, price and taste are most often selected and no artificial ingredients, convenience and animal welfare least often, with animal welfare chosen in the top 3 by 15.0%.

In a choice experiment consumers ranked pork produced in a natural way as most important, followed by avoiding human health risks, ensuring the best taste, and avoiding stress and avoiding pain. Pharmaceutical interventions only in case of medical need scored lowest. Consumer perception of immuno-vaccination is expected to depend on how consumers relate this to pork production aspects at a general level - naturalness - and at a more specific level - pharmaceutical interventions.

ENDING SURGICAL CASTRATION OF PIGS

Dr.ir. G.B.C. Backus, Wageningen UR

The Dutch pig industry aims at ending surgical castration of male piglets. This project presents the results of a five year research on entire male pigs. Using observational and experimental studies data were collected in various segments of the pork supply chain. Consumer acceptance of boar meat was evaluated using sensory evaluations at home tests and in a laboratory setting. The accuracy of corrective measures to detect boar taint at the slaughter line was determined. The impact of preventive measures (breeding, feeding, housing conditions) on boar taint levels and on mounting and aggressive behaviour was assessed. Using cost estimates and technical parameters, the economics of producing entire male pigs, compared to producing barrows were evaluated. Consumers evaluate meat from entire male pigs that passed the boar taint detection test comparable to meat from gilts, whereas meat samples that did not pass this test were evaluated less favourable. Breeding was an effective preventive measure to reduce boar taint. On farms with appropriate management and housing conditions a reduced level of mounting and aggressive behaviour was observed. Instrumental detection methods at the slaughter line may be more cost-effective than sensory assessment of boar taint, but are not available yet. Assessing similarity of the rank order comparison between consumer perception and three selected boar taint detection parameters for the consumer perception attribute odour resulted in Kendall's W values equal to 0.63 ($p=.092$) for the human nose score, 0.50 ($p=.482$) for androstenone levels, and 0.56 ($p=.263$) for skatole levels. This indicates that human nose scores were the best predictor of the rank order of consumer perception of the three. Assessors trained for human nose scoring can be used for half an hour of nonstop assessment without fatigue of the assessors occurring.

THE EFFECTS OF ANALGESIA AND LOCAL ANAESTHESIA ON BLOOD CORTISOL CONCENTRATION DURING SURGICAL CASTRATION IN MALE PIGLETS

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According to regulations, the majority of male piglets are surgically castrated without anaesthesia in Hungary, during the first week of life. Castration without anaesthesia is a source of intense pain that impairs welfare. Our aim was to measure the effects of using analgesia and local anaesthesia during castration on the blood cortisol level and body weight (BW) gain in male piglets.

Four groups of 3-5 day old male piglets were formed as follows: 1) Control group (CO; n = 49), castrated without anaesthesia, according to the law in operation; 2) piglets receiving i.m. Meloxicam (0.4 mg/BW kg) as analgesia 10 min prior to castration (ME; n = 50); 3) piglets receiving the same amount of Meloxicam as the ME group and lidocain (0.5 ml 2%) into the testes as local anaesthesia 10 and 2 minutes prior to the castration, respectively (MELI; n = 50); 4) piglets receiving the same amount of Meloxicam as the ME group 10 minutes prior to and 6 hours after the castration (MEME; n = 48). Blood samples were taken prior to castration or the first shots of Meloxicam and 40 minutes after the castration. Blood cortisol concentration was measured by RIA. The body weight of the piglets was measured prior to the castration, and then weekly until weaning (28 days).

We found that the blood cortisol concentrations were elevated after the operation, suggesting that stress was experienced through the procedure. However, there was no difference in the post-operation cortisol concentrations between any of the groups. Regarding the BW gain, we found no difference between the groups, though the initial BW of piglets in the MELI group was significantly lower compared to the other groups.

We have concluded that the efficiency of local anaesthesia and/or analgesia in reducing stress was not proven.

D6 CASTRATION AND PRODUCTION OF ENTIRE MALE PIGS

EVALUATION OF MELOXICAM AND EMLA® FOR PAIN MITIGATION IN PIGLETS UNDERGOING SURGICAL CASTRATION

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In North America, over 100 million neonatal pigs are subject to painful procedures each year, including tail docking and surgical castration. While these practices have been demonstrated to cause significant pain and distress to piglets, they are often performed without the use of appropriate analgesics or anaesthetics. This has a serious impact on the welfare of these animals. The objectives of this study were to assess pain in castrated piglets using validated behavioural scoring techniques and use these assessments to evaluate the analgesic efficacy of meloxicam (0.4 mg/kg, IM) and EMLA® (a topical anaesthetic eutectic mixture of prilocaine/lidocaine) given 30min prior to castration. This study has strong relevance to the field of piglet welfare, as providing piglets with an analgesic and/or anaesthetic to reduce castration-associated pain may significantly improve their overall peri-procedural well-being. In total, 4 litters of 5 day old piglets (n=19) were surgically castrated with treatments randomized across litters: meloxicam + EMLA®, meloxicam + non-medicated cream, saline + EMLA®, saline + non-medicated cream and no treatment (n=2-5 piglets/group). Each pen was videorecorded for 1h, 24h pre-procedure, immediately after castration for 7h and again for 1h, 24h post-procedure. Thirty behaviours and postures were scored continuously for the first 15min at -24, 0, 1, 2, 3, 4, 5, 6, 7 and 24h by an observer blinded as to time and treatment. Data was analyzed using a mixed model ANOVA with repeated measures and a post-hoc Tukey test. All piglets displayed significantly more inactive behaviours (e.g., lying, sleeping) than active behaviours (e.g., walking, running, playing, nursing) up to 6h post-castration. The use of meloxicam and EMLA® were not associated with a reduction in painful behaviours or postures compared with untreated piglets. Our findings indicate that the current recommended dose of meloxicam is not effective in alleviating castration-associated pain in neonatal piglets.

BEHAVIOURAL CHANGES STIMULATED BY OCCUPATIONAL ENVIRONMENTAL ENRICHMENT IN FATTENING PIGS IN INTENSIVE FARM SYSTEM

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Pig housing in intensive production system normally do not offer sufficient stimuli to promote highly motivated behaviors. When environment or substrate are not adequate, redirected exploring behavior towards their pen mates may arise, impacting negatively the pig's welfare and, consequently their productive performance. Environmental enrichment (EE) has been proved as an alternative method to enhance the expression of highly motivated behaviors, however, is not always applicable to industrial scale. The present study explores the viability and effectiveness of two types of environmental enrichment items on the behavior of fattening pigs of a Chilean Company.

The objectives of this study were: i) to evaluate the effect of two EE objects: balls (B) and a Fixed chewable toys (FChT); ii) Evaluate three exposure times to EE (2h, 1h and 0.5h); iii) evaluate the behavioral response after EE was applied.

Experimental groups (144) were selected randomly from 12 houses. Three treatments were compared: control, B and FChT and EE objects were applied for 0.5, 1 and 2h. Behavioral observations were conducted 1h before, during EE and 1h after EE. Behaviors recorded were: Exploring and interaction with EE objects, lying, positive and negative social interactions (PSI and NSI). Exploring increase during EE ($p < 0.05$) and decrease 1 h after EE; lying decrease during EE and increase 1 h after EE was implemented; PSI and NSI had low frequencies and fell during EE ($p < 0.05$) and increased post EE ($p < 0.05$) for both treatments (B and FChT). Exploring yard was greater using B, however exploring to EE was higher to FChT. The exposure time to toys showed no statistical difference between 0.5 and 1h, but a lower response to 2h ($p < 0.005$). We concluded that the use of ball and fixed chewable toys were applicable and promoted innate behavior in fattening pigs, however chewable items had a greater impact.

EVALUATION OF COSTS AND BENEFITS IN THE USE OF ENVIRONMENTAL ENRICHMENT: AN INNOVATIVE TOOL FOR SUPPORTING FARMERS TO MAKE THE RIGHT CHOICE

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The EU legislation strongly encourages the use of environmental enrichments for pigs of different ages, housed in intensive farms. Many advantages derive from the permanent use of straw or manipulable materials: increased explorative behaviours, low levels of aggressiveness or reduced incidence of tail biting. Despite that, farmers are not always aware about the advantages and frequently worried about the possible increase of costs and labour. Within the framework of Ager project "Filiera Verde del Suino", a detailed comparative economic analysis was performed taking into account different manipulable materials for environmental enrichment in weaning and fattening pigs: costs, benefits and their effect on meat production were calculated. The results of this analysis were made available to farmers by the development of a useful tool able to provide information and improve the awareness about the use of environmental enrichments. This tool is a free and open-source form currently available on the project website. Farmers may select the category of animals, housing system and type of environmental enrichments (different woods and ropes, presented with different devices); the system automatically calculates costs (split into investment, amortisation, labour and material) and suggests how to use that enrichment, for improving the results in terms of animal welfare and profit. The tool also calculates the costs when no environmental enrichment is used: common welfare issues are described and the farmer is asked to complete information about the incidence of tail biting in the farm. The economic loss resulting is automatically generated.

Raising awareness and promoting the spread of knowledge on the correct application of the environmental enrichment in pigs might ensure the effectiveness of their introduction and assure compliance with the EU legislation. Innovative tool (e.g. web-based survey, learning object) will help to reach a large number of farmers and support them directly in management decisions.

THE USE OF DIFFERENT STRAW DISPENSERS IN WEANED PIGS

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Pigs of all ages should have access to suitable materials, such as straw, to enable investigation and manipulation activities. Furthermore, the provision of these materials might prevent the development of harmful behavior, such as tail and ear biting. Current intensive housing systems with slatted floors however, impede the use of large quantities of these materials. Consequently, enrichment material can be provided in smaller quantities to avoid too much straw loss through the slatted floors. The aim of this study was to verify the use of straw dispensers filled with fully chopped straw in weaned pigs. During this study, two types of straw dispensers were presented to a total of 77 pigs. The first dispenser was a vertical tube (height: 70cm; width: 34cm) with one dispensing unit at the bottom (TUBE). The second dispenser consisted of a rectangular reservoir (height: 40cm; width: 80cm) with four levers at the bottom (RESERV). Both dispensers were positioned above the feed trough. A control group (n = 52) of pigs in barren pens without enrichment was also included in the study. Individual behavioral observations were carried out on three days per week, between 14:00h and 17:00h. Data were analyzed using logistic mixed models. The results show a higher straw use in presence of the straw reservoir (29.72g/pig/week) compared to the straw tube (6.20g/pig/week). Both dispensers seemed to decrease ear biting and aggressive behavior, as these behaviors were seen more frequently in control pens. Nosing pen mates was seen more frequently in pens with a reservoir. These pigs also tended to show more tail biting. The results from this study should however be interpreted carefully, as the dispensers were tested in only a limited number of animals.

EVALUATION OF NOVEL ROPE FLAVORS AS ENVIRONMENTAL ENRICHMENT FOR STALLED GILTS

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Developing effective devices and approaches for environmental enrichment is important for improving pig welfare and productivity. Therefore, our objective was to evaluate the use of flavored ropes as environmental enrichment for individually housed gilts. Twelve crossbred gilts (112 ± 12 kg) were individually penned and provided ad libitum feed and water. Four rope treatments were evaluated which included ropes soaked in 1) water ($n=5$), 2) salt water ($n=6$), 3) sugar water ($n=6$) and 4) apple juice ($n=7$). A randomized crossover design was utilized so that gilts were tested on two of the four treatments. Cotton rope (1.2 m) was soaked in the assigned treatment solution for 30 minutes on day 1. The rope was tied to an overhead bar at 10:00 hours on day 1 and was removed at 19:00 hours on day 2. Gilts were video recorded one day before treatments were given (day -1) and throughout the study. Video was analyzed using a 2-minute scan sample interval between 07:00 and 19:00 hours. Oral/nasal contact with the rope, standing and lying postures were recorded. Postures collected on day -1 and 07:00 to 10:00 hours on day 1 are referred to as baseline. Data were analyzed using the Glimmix procedure of SAS including the fixed effects of treatment, day, their interaction, and the random effect of treatment order. The apple juice treatment resulted in gilts standing more than baseline, salt and sugar water treatments ($P=0.03$). Gilts with apple juice, salt and sugar water treatments were observed lying less than baseline ($P=0.02$). Oral/nasal contact was not different between rope treatments ($P=0.87$). Regardless of treatment, gilts had less oral/nasal contact with the rope on day 2 than day 1 ($P<0.01$). Overall, these results suggest that flavored rope enrichment does not alter oral/nasal contact, but may impact activity levels in individually penned gilts.

IMPACT OF A NEW NATURAL MANIPULABLE MATERIAL ON PIG BEHAVIOR AND HEALTH

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Pigs must have access to material to enable investigation and manipulation activities (Council Directive 2008/120/EC). This study aimed at assessing a new manipulable material, compatible with slatted floor, on pig behaviour and health. This material of different designs, destructible and edible, is composed of dehydrated and compressed brown algae (Algopack, Saint-Malo, France). The study was conducted in the experimental facilities of Anses, Ploufragan, France. First step was carried out on 8 batches of 5 weaners, given during four weeks (weeks 4 to 8 of life) panels put on wire floor to lie down and made of algae vs. wood (0.19 m² per pig). Second step was carried out on 4 batches of 5 and 3 growers (weeks 12 to 19), given algae cylinders threaded on a rope or on a metallic rod (10 cm diameter and 3 to 20 cm length) vs. metallic chains or objects. All materials were hung from the wall. Pigs were daily observed and their body temperature was recorded. They were weekly weighed. Their behaviour was video recorded during each period and analysed by scan sampling. Neither health trouble nor fever were observed. Weaners and growers of each batch had the same weight. Weaners lay down on the algae panels as well as on the wood panels. More than 50% of the algae panels were disintegrate by pigs, although the wood panels remained intact. Growers given algae cylinders manipulated them more than did the pigs with the metallic objects. They performed less aggressive behaviours and less oral manipulation of penmates. They disintegrate the cylinders in a few days. This natural material, enjoyed by pigs, is well investigated and manipulated and decrease negative behaviours directed against penmates. However, its design and/or presentation need to be refined to last longer, particularly in growers.

DO INCREASING AMOUNTS OF STRAW INCREASE GROWING PIG'S ORAL MANIPULATION OF STRAW?

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According to European legislation, pigs must have permanent access to a sufficient quantity of material in order to satisfy their need for investigation and manipulation activities. However, only few investigations have focused on quantification of "sufficient". We investigated the effect of increasing amounts of straw on oral manipulation of straw in order to identify the amount, where additional provision of straw did not increase the behaviour further. Pigs were housed in 90 groups of 18 pigs in pens with partly slatted concrete floor (0.7 m²/pig) and provided with uncut straw daily on the solid floor. Experimental treatments were 10, 80, 150, 220, 290, 360, 430 or 500 g straw per pig and day. At 40 and 80 kg live weight the behaviour of three pigs per pen (large, middle and small) was recorded continuously during 1 h before straw allocation, 1 h after straw allocation and from 17 to 18 h. With increasing amounts of straw, we found a linear ($P < 0.001$) and curvilinear ($P < 0.01$) increase in the time pigs spent manipulating straw; the curve showed the steepest increase from 10 to 360 g and levelled out after that. Pigs spent more time manipulating straw at 40 than at 80 kg live weight (346 vs. 250 s/h; $P < 0.001$), and relatively small pigs spent more time manipulating straw (367 s/h) than relatively medium and large sized pigs (274 and 252 s/h; $P < 0.001$). The results show that increasing the straw amount from 10 to 360 g straw per pig per day increases the time pigs spent in oral manipulation of straw markedly, while increasing the straw amount above 430 g straw per pig per day had no additional effect. Thus, approx. 400 g straw per pig per day maximizes straw-directed behaviour in the present type of housing.

INCREASING AMOUNTS OF STRAW INCREASE GROWING PIG' PRODUCTION AND HEALTH

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Housing in straw-based systems has been shown to improve animal welfare and production, while the provision of limited straw in conventional pens with concrete flooring has shown variable effects. In TrialI, the effect of provision of straw on the severity of gastric ulcers was investigated in pigs provided with 10, 500 or 1000 g uncut straw per pig per day and n=15 pigs per treatment. After euthanization, lesions of the non-glandular part of the stomach were characterized and scored as normal, hyperkeratosis, erosion or ulceration. The proportion of pigs with ulcerations was lower in the group provided with 500 or 1000 g compared to 10 g straw per pig per day (7 vs. 33%; $P < 0.05$). In TrialII, the effect of the amount of straw on the average daily weight gain (ADGpig) and feed conversion ratio (FCR) from 30 kg to slaughter were investigated using 122 groups of 18 pigs housed in pens with partly slatted concrete flooring (0.7 m²/pig). The pigs were fed a commercial dry feed for ad libitum intake and provided with uncut straw on the solid floor daily. Experimental treatments were 10, 80, 150, 220, 290, 360, 430 or 500 g straw per pig per day. Pigs were weighed at introduction at 30 kg and again around 85 kg. The ADGpig increased by 8 ± 17 g/day for every extra 100 g straw added daily ($P < 0.001$) resulting in 42 g higher ADG-pig at 500 compared to 10 g straw per pig per day (ADGpig at 500/1000 g straw: 1067 ± 18 g/day; ADGpig at 10 g straw 1025 ± 18 g/day). FCR was not affected by amounts of straw. Based on these results, production and health parameters were improved by provision of increasing amounts of straw to pigs kept in conventional pens.

INFLUENCE OF DIFFERENT STRAW BEDDING MANAGEMENT ON WELFARE OF GROWING PIGS IN LOW ENVIRONMENTAL IMPACT FARMING SYSTEM

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Low environmental farming system requires nutrient recycle and production of renewable energy. The anaerobic digestion of pig manure produces a low quality biogas; hence, the addition of plant biomass results necessary. Straw bedding is the most effective environmental enrichment for pigs housed in intensive farms, facilitating exploratory behaviours and reducing negative behaviours (e.g. excessive aggressiveness, cannibalism).

The aim of this study is to evaluate welfare of growing pigs in a straw-based housing system with different frequencies of bedding removal.

This research promotes the implementation of sustainable farming systems with respect of animal welfare and environmental protection.

A total of 840 growing pigs were equally allocated to a 2x2 experimental design according to quantity of straw provided (LQ=250g/pig/die; HQ=450 g/pig/die) and frequency of removal (LF=additional bedding added at day 30; HF=bedding removed and replaced every 15 days). Pigs were housed for two months in identical pens with resting area on straw bedding and feeding area on partially slatted floor. Animals were fed ad libitum. Cleanliness of straw bedding and lesion and cleanliness of pigs were collected three times (at day: 30, 45, 60).

Straw bedding resulted dirtier when low quantity of straw was provided (LQ=74.24%; HQ=61.97%). Significant differences were found for pig cleanliness both in LQ (P=0.002) and HQ (P=0.013) groups. Frequency of removal never influenced cleanliness of pigs and bedding. The incidence of lesions was always low without differences among groups.

High quantity of straw provided showed advantages in terms of welfare compared to the quantity normally suggested in straw-based systems (200-250 g/pig/die), whereas adding straw during the production cycle is sufficient to assure a good management of the bedding. Further research is needed to evaluate the economic impact of the quantity provided, considering the adding value of a good quality and more sustainable biogas production.

EFFECT OF ENRICHMENT DESIGN AND AMOUNT ON DURABILITY AND USE

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Environmental enrichment provision is a legal requirement in pig production. This study investigated two rubber device designs (on the floor v's hanging; Easifix™) with regard to durability, and how often pigs interacted with them, at two allowances (1 v's 3 devices), when provided to a group of 36 sows. Devices consisted of a solid central mass with arms extending outwards (Floor, n = 12; Hang, n = 3 arms). 'Hang' was suspended to pig head height. 'Floor' was supported off the ground by the tips of 3 arms at any one time. Sows were initially provided with 6 devices (3 Hang + 3 Floor) for 4 days (control), then treatment combinations (device type × allowance) provided sequentially over time. Treatments were applied for four days, interspersed with three day control periods. The following measures were taken before and after each treatment period: device weight and arm length, and sow ear and tail scores. Scan samples of the number of interactions between sows and devices were recorded between 0900 and 1700 at 5 min intervals for the last two days of each treatment period. 'Floor' lost more weight than 'Hang' (0.47 ± 0.08 v's 0.00 ± 0.07 g/pig/day; $P < 0.001$). Arm length of 'Hang' didn't change during the trial. However 'Floor' lost more arm length per day when there was only 1 device provided than 3 devices (1.2 ± 0.1 v's 0.1 ± 0.0 mm/day; $P < 0.01$). Within device type, pigs had lower ear lesion scores when provided with 3 rather than 1 device (Floor: $P = 0.7$; Hanging $P < 0.05$). Pigs had more interactions with 'Floor' than 'Hang' ($P < 0.01$) overall, and when adjusted for the number of devices ($P = 0.01$). More interactions per device occurred when there was only one 'Floor' compared with any other treatment ($P < 0.05$). This preliminary study suggests that this floor device design is attractive to pigs; it was used more than 'Hang' and lost more weight. Increasing the number of devices could reduce competition and aggression related injuries.

F1 TAIL BITING AND INTACT TAILS

TAIL BITING - RISK FACTORS FOR BEING BITTEN AND THE EFFECT OF STRAW ON TAIL LESION PREVALENCE

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The risk of being a victim of tail biting partly depends on characteristics of the victim itself. For example, one study suggests that higher-ranking, heavier pigs are more likely to become victims than their pen mates. Numerous studies have shown that access to straw reduces the risk of tail biting. However, it is not clear how straw provided in the farrowing or weaner units affects the prevalence of tail lesions in finishing pigs.

Two existing datasets were analysed with the following aims: (1) to identify factors relating to the individual pig that are associated with an increased risk of being tail-bitten, and (2) to investigate the effect of straw provided in the farrowing, weaner and finishing unit on the prevalence of tail lesions recorded at slaughter.

Dataset 1: In each of three herds, a cohort of 672-924 pigs (tail docked) was followed from weaning to slaughter/death. Pigs were weighed individually, and the cause and date of individual medical treatments were recorded. The association between the risk of being tail-bitten (according to the treatment data) and potential risk factors related to gender, growth and health was analysed by logistic regression analysis. Castrates had a higher risk of being tail-bitten than females. Weight and age at weaning were not associated with the risk of weaners being tail-bitten. Weight at transfer to the finishing unit was not associated with the risk of finishers being tail-bitten. Pigs that had received individual medical treatment in the weaner unit did not have a higher risk of being tail-bitten in the finishing unit.

Dataset 2 comprised data from 80 sow herds with associated production of finishers. Straw provided in the farrowing and finishing units was associated with a lower prevalence of tail lesions at slaughter. No effect of straw provision in the weaner unit could be established.

ASSOCIATIONS OF TAIL BITING IN PIGS WITH IMMUNE PARAMETERS

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In pigs, physiological imbalance may lead to an increased motivation to explore and forage, thereby enhancing the risk of tail biting behaviour under suboptimal environmental conditions. In several species genetic and physiological relations have been found between damaging behaviours and immune responses. Therefore, we studied relationships between immune parameters and tail biting in pigs. Pigs (n=480) weaned at 4 weeks were housed either barren (B; concrete floor with slats) or enriched (E; straw-bedding). Tail biting and tail wounds were recorded during the weaner (WP), grower (GP), and finisher phase (FP). Per phase, pigs were characterized as tail biter, victim, tail biter/victim, or neutral. Leukocytes, immunoglobulins (Ig), complement activity and haptoglobin levels were determined at weeks 8, 9 (3 days after 24-h mixing) and 22. Mixed models with type of pig and round (1-5) as fixed effects and pen as random effect were used per phase and housing condition. Leukocyte counts were unrelated to tail biting. In several phases, however, tail biters had highest IgG titers (B: GP $P<0.01$; E: FP $P<0.05$), the highest increase from w8 to w9 in IgG (B: $P<0.10$) and in haptoglobin concentrations (B: $P<0.01$), and lowest haptoglobin concentrations in w8 (B+E: GP $P<0.05$), w9 and w22 (E: FP $P<0.05$ and 0.10, respectively). B biters in FP had, furthermore, highest classical complement activity in w8 ($P<0.01$). E biters in FP had lowest alternative complement activity in w8 with the highest reduction after mixing ($P<0.05$). Hence, tail biters showed differences in immune parameters from other pigs. However, relationships were not always consistent over phases and housing, suggesting a temporary physiological change in tail biters. To conclude, tail biting seems to be associated with the immune status of pigs. This knowledge may help in understanding the etiology of tail biting and to develop preventive strategies against damaging biting behaviours.

THE SCHWIP MANAGEMENT TOOL FOR TAIL BITING IN FATTENING PIGS: A COMPREHENSIVE APPROACH FOR A COMPLEX PROBLEM

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Tail biting is a frequent multifactorial problem and high impact welfare issue in pigs. In many countries pigs are tail docked as a counteractive measure, which reduces the problem but does not eradicate it and furthermore poses a welfare problem in itself. This project aimed at developing and evaluating a novel tool for tail biting prevention in fattening pigs which includes knowledge transfer through an advisory concept hitherto unused in German fattening pig production.

The tail biting prevention tool named "SchwIP" combined animal health and welfare planning (AHWP) with farm individual risk assessment. The core instrument was an automated spreadsheet which allowed farm assessment through interview and direct observations as well as feedback in form of an individualised report within one day. One researcher and 84 trained farm advisers and veterinarians (AV) applied SchwIP on 188 conventional German farms twice within one year (A1, A2). After A2, 146 of the participating farmers and 48 AV completed anonymous feedback questionnaires.

Across all farms, total tail biting risk (range 0 to 100 risk points) significantly decreased from A1 to A2 (median difference -3.5, Q25=-8.2, Q75=1.1; Wilcoxon signed rank test, $p < 0.01$). Prevalences of bloody tails, swollen tails, tail losses and ear lesions also decreased significantly (median differences range 0 to -2.2%; Wilcoxon signed rank test, all corrected $p < 0.05$). The approach in general was well received by participants. Farmers stated to have gained new knowledge on tail biting causation (70%) and a new overview of tail biting causes on their farm (79%). Furthermore, 79% of AV stated that they would be able to integrate SchwIP in their daily work.

Taken together, our results indicate that combining risk analysis with AHWP is a promising approach for the reduction of tail biting in fattening pigs.

TAIL LESIONS ON CARCASSES OF IRISH SLAUGHTER PIGS IN RELATION TO PRODUCER ASSOCIATION WITH ADVISORY SERVICES

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Advisory services work to improve farm performance through better management and this could be reflected in pig welfare indicators. In an effort to validate tail lesion scores on carcasses as indicators of pig welfare, the influence of membership of the Teagasc pig advisory service on tail lesions was determined.

Two factories were visited in 2014 (3-4 days). Two observers scored each carcass after scalding and dehairing on the slaughterline for sex, herd and tail lesion scores (0-5). Scores were collapsed into none/mild (0+1), moderate (2) and severe tail lesions (≥ 3). The prevalence and range of these categories were determined at batch level. Effects of sex, client status, and observer were analysed by PROC GLIMMIX with random effect for batch within herd.

13 133 carcasses were inspected from 61 farms (23 clients). Moderate and severe tail lesions were present in 25.2% and 3.1% of the pigs. Batch level prevalence ranged from 3.2-70% for moderate and 0-21.4% for severe tail lesions. Males had higher odds of moderate (OR=1.4, 95% CI 1.25-1.49) and severe tail lesions (OR=3.0, 95% CI 2.39-3.82). Pigs from clients had lower odds of moderate tail lesions (OR=0.5, 95% CI 0.33-0.85) but no differences were found for severe tail lesions.

Tail lesions are common and large variation exists between batches suggesting there is room for improvement in management of tail biting on Irish farms. No difference was found between clients and non-clients for severe tail lesions which suggests that risk factors for outbreaks of severe tail biting are not influenced by factors related to membership of an advisory service. However, clients had lower odds of pigs with moderate tail lesions suggesting that improvements in housing and management of pigs associated with membership of the advisory service reduced the risk of tail directed behaviour leading to moderate lesions in slaughter pigs.

F5 TAIL BITING AND INTACT TAILS

EXPERIENCES WITH INTACT TAILS IN WELL-MANAGED CONVENTIONAL HERDS

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More than 95 % of the Danish pigs are tail docked because of the reduced risk of tail biting among docked pigs. At the Danish welfare summit meeting in March 2014, the Minister for Food, Agriculture and Fisheries and delegates from the Danish agriculture and retail trade signed a declaration aimed at reducing the number of tail docked pigs in Denmark.

The objective of this pilot study was to investigate the effect of cessation of tail docking in well-managed conventional farms with a very low incidence of tail biting among tail docked pigs.

In two conventional herds, 80-90 pigs per batch were not tail docked (23 pens in herd 1 and 45 pens in herd 2). Pigs with intact tails were housed under the same conditions as pigs with docked tails. If tail biting occurred, additional enrichment was provided to stop the tail biting. The number of tail bitten pigs were counted every second week.

The results showed a large difference in tail biting incidence between herds. Between 7-30 kg, 2.2 % of the pigs with intact tails were tail bitten in herd 1, whereas 8.2% of the pigs were tail bitten in herd 2. Between 30-60 kg, 7.8 % of the pigs in herd 1 and 20.3 % in herd 2 were tail bitten. In herd 2, 51 % of the pigs with intact tails had a tail lesion at least once between 7-110 kg.

In conclusion, based on this pilot study, a cessation of tail docking can increase the incidence of tail biting even in well-managed herds. Knowledge gained in this pilot study will be included in an upcoming PhD-project: Tail biting - Early recognition and targeted prevention. The PhD-project is conducted jointly by SEGES – Danish Pig Research Centre, University of Copenhagen and Scottish Rural College.

F6 TAIL BITING AND INTACT TAILS

STRAW USE AND PREVENTION OF TAIL BITING IN UNDOCKED PIGS; A SURVEY OF HOUSING AND MANAGEMENT ROUTINES IN SWEDISH PIG FARMS

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The background of tail biting is multifactorial and risk factors have been identified; e.g access to straw. In fattening pigs kept in fully slatted pens with no access to straw tail biting is common. Although tail docking was banned 2001 in EU, tail docking is often used routinely to prevent tail biting, except in Finland, Sweden and Lithuania.

The aims of the survey were to obtain descriptive data from Swedish farmers about pig housing and management in relation to straw access and tail biting in nursery and finishing pigs. A telephone questionnaire with 108 questions about basic farm data including housing, feeding and management routines was performed in 2014. Data were obtained from 60 farmers, of which 46 farms had weaners (average 1090 pigs placed; min 126; max 4000) and 43 farms had finishing pigs (average 1430 pigs placed; min 132; max 6500).

In 50% of the nursery farms tail biting was never seen, and in 39% tail biting was seen ≤ 2 times/year, in 8% 3-6 times/year and in 2% ≥ 1 times/month. Farmers with finishing pigs reported on average 1.6% tail bitten pigs per batch (min 0.1; max 6.5).

All farms used straw, and straw was cut or chopped in 78% of the nursery farms and in 74 % of the finishing farms. On average straw was distributed 7.5 times/week (min 0.5; max 14).

In 58% of nursery farms and 83% in the finisher farms straw never caused blockages or other problems with the manure handling system. Thirty-one percent (nursery) and 17% (finishing) had problems a few times a year, and 11% (nursery) and 2% (finishing) at least once/month.

The Swedish farmers reported limited problems with tail biting, as straw was provided, more or less daily. The straw rarely caused problems in manure system. The study is a part of FareWellDock (farewelldock.eu).

THE EFFECT OF AN ENRICHED ENVIRONMENT ON BITING BEHAVIOR AND PERFORMANCE OF FINISHING PIGS WITH INTACT TAILS

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Tail docking is often carried out to prevent excessive tail biting. It is however the question if pigs can be raised with intact tails. Furthermore, it should be verified if these pigs need an enriched environment to avoid tail biting outbreaks. The aim of this study was therefore to verify differences in behavior and performance between finishing pigs ($n = 90$) housed in barren pens (control) and enriched pens (treatment). Pigs in barren pens only had access to a chain with a toy as enrichment material. In treatment pens, a hiding wall was constructed and pigs had access to dispensers filled with straw blocks. A chain with a toy was also present in these pens. All pigs had intact tails. Behavioral observations were carried out once a week, between 9:30h and 12:00h and between 13:30h and 16:00h. Body weights of the pigs were recorded individually at the start of the trial, 6 weeks later (weighing 2), 12 weeks later (weighing 3) and at slaughter age when a weight of 110 – 120kg was reached. Behavioral data were analyzed using logistic mixed models (PROC GLIMMIX). Body weights were analyzed using linear mixed models (PROC MIXED). Statistical significance was accepted when $P < 0.05$. The preliminary results reveal no difference in tail and ear biting between control and treatment groups over the entire experimental period. However, tail biting was only seen to a limited extent, despite the fact that pigs had intact tails. As some pigs had tail lesions at the start of the experiment, it seemed that tail biting mainly occurred before the finishing stage. Treatment affected biting towards other body parts (paws, side) and this behavior was observed more frequently in control groups. Pigs in treatment groups seemed to perform better, as they reached higher slaughter weights.

CURLY TAILS: THE DUTCH APPROACH

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Despite EU legislation and societal concerns, in current pig farming, most piglets are still tail docked. The pig farming sector would prefer to stop tail docking. However, without additional preventive measures, tail biting will likely increase. Several Dutch parties have designed the Declaration of Dalfsen, containing a careful road map towards curly tails. This map comprises a demonstration project, development of a toolbox and knowledge exchange, and aims at closing the gap between science and practice and relieving the anxiety and scepticism about keeping pigs with long tails in current systems. In 2014, every six weeks a batch of twelve undocked litters was included in the demonstration. Circumstances were optimized as much as possible, and additional enrichment was provided. Caretakers were coached to recognize early signs of animals at risk. Nonetheless, tail damage appeared. Mostly in individual animals, but occasionally as an outbreak at pen level (for which predictive correlates are searched). Remarkably, at three weeks of age, several piglets already showed bite marks at the tail. Attitudes of the caretakers changed during the year to a higher level of alertness and an active approach towards required management changes. A traffic light system was implemented to safeguard attention towards groups at risk. The use of some enrichment materials encountered practical problems, and labour required for adequate monitoring and providing materials was higher than expected. The toolbox is still being developed and tested, describing effective curative measures. A network of farmers keeping pigs with long tails was formed, to support exchange of knowledge and experiences. All knowledge gained will feed an educational programme for pig farmers and farm advisors to enable a responsible transition towards longer tails. The key to success of this approach is that pig farmers are at the steering wheel, with guidance from actors in the chain.

FREE-RANGE PIGS INTEGRATED WITH AGROFORESTRY

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Among consumers there is an increasing interest in pork from conventional and organic free-range production. In many ways free-range production support animal welfare in terms of animals being able to perform species-specific behaviour. However, there are also some serious challenges related to animal health and welfare. Sudden death of lactating sows related to the disease complex called 'summer-sows' is a huge challenge on some farms and is expected to be related to heat stress. Furthermore, sows are snout-ringed which prevents them from performing species-specific behaviour such as rooting. Rooting destroys the grass cover thereby increasing the risk of nutrient leaching. Integration of free-range pigs with agroforestry, e.g. production of tree biomass for energy production, could have some immediate animal benefits. The crops provide a more natural and stimuli-rich environment for the pigs with possibilities to seek shadow in hot seasons and shelter in cold seasons. In addition, the system may eliminate the need for snout-ringing due to uptake of nutrients from the trees independent of grass cover.

The aim is to quantify the expected positive effects of integrating free-range pigs with agroforestry in terms of animal health and welfare, environment and performance. An on-farm experiment will be carried out to investigate the behaviour of lactating sows and piglets as well as nutrient leaching in paddocks with poplar trees and paddocks without poplar trees. Among others, explorative behaviour in lactating sows and play behaviour in piglets will be recorded as well as the pigs' use of the additional resources in terms of trees in the system with poplar. Furthermore, clinical signs of MMA and signs of heat stress (e.g. respiratory rate) will be registered.

UHF – WITH FOCUS ON PIG WELFARE IN OUTDOOR PRODUCTION SYSTEMS

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The consumers expect outdoor production systems to promote a high level of animal welfare. Therefore, it is vital to maintain and improve animal welfare in these systems by means of research and development activities.

The Center of Development for Outdoor Livestock Production (UHF) is a research and development unit, established jointly by the Danish Animal Welfare Society and the food company Friland A/S, specialized in international marketing and selling of organic and free-range meat. The goal of UHF is to increase the number of pigs reared in outdoor production systems, which have been awarded with the recommendation of the Danish Animal Welfare Society. UHF carries out projects that aim to improve animal welfare, environment as well as production efficiency on-farm. We focus on development of outdoor production standards with several projects concerning facilities and husbandry methods for production of outdoor pigs.

- I. Development and testing of a multi-sow farrowing hut with improved piglet survival and farmer working conditions – in collaboration with farmers, advisors and hut producers. Results so far indicate potential advantages regarding working environment for the farmer, while more data are needed to evaluate the effect on piglet survival.
- II. Development and testing of a system for outdoor rearing of growing pigs – in collaboration with farmers and advisors. On-farm testing of the system showed that it is indeed economically feasible and functional all year, ensuring high animal welfare without compromising the environmental load.
- III. Testing of methods for outdoor rearing of entire male pigs without boar taint – in collaboration with farmers and researchers. The project focuses on pigs foraging on Jerusalem artichokes, with results so far suggesting a low occurrence of boar taint in the animals.

UHF participates in projects aiming to improve pig welfare in outdoor production systems, in close collaboration with farmers, advisors and researchers, from universities as well as the industry. In particular we are committed to carrying out projects related to improving animal welfare as well as production conditions and husbandry on-farm.

QUALITATIVE ASSESSMENT OF CURRENT SITUATION AND FUTURE AIMS BY ORGANIC PIG FARMERS

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The CORE Organic II project ProPIG aimed to assess animal health and welfare as well as environmental impact on organic pig farms across three husbandry systems in Europe (indoor, outdoor and partly outdoor) and to develop farm specific improvement strategies. 74 farms across the 8 project countries were visited three times within one year. In addition to assessing animal health and welfare indicators and environmental impact, semi-qualitative interviews were conducted on 63 farms during farm visits 1 and 3 to evaluate the farmer's satisfaction with the status quo, perception of future aims and ideas for improvement. Some questions were asked as open questions, while others used a five-point answer scale.

A descriptive classification of the responses to the open question regarding the goals for the immediate future revealed that most farmers were aiming to improve either health (19 responses), performance (13) or welfare (9) (two answers per farm were possible). Improving welfare was exclusively a topic for indoor or partly indoor farmers, whereas improving performance was proportionally more often mentioned by outdoor farmers. Similar results were found when asked to rate the satisfaction with pig health and welfare at visit 1: 9% (3) and 38% (13) of indoor farmers were very satisfied with the health and welfare situation, respectively (point 5 on the scale), whereas on outdoor farms 50% (6) were very satisfied and 50% (6) satisfied. Outdoor farmers were less satisfied with the production level (25% (3) very satisfied, 9% (1) satisfied and 66% (8) neutral). 63% (40) and 53% (33) of all farmers across the three systems stated that an improvement in terms of health or welfare, respectively, is needed and also possible to implement. Our results show that organic pig farmers, in general and especially when pigs are kept indoors, are aware of problems relating to animal health and welfare and are willing to improve.

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For further information see: www.coreorganic2.org

DOES ANIMAL HEALTH AND WELFARE OF ORGANIC PIGS DIFFER BETWEEN HUSBANDRY SYSTEMS?

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In the course of the CORE Organic II project ProPIG, animal health and welfare (AHW) of organic pigs in 8 European countries was assessed to compare three husbandry systems (using non-parametric tests with $p < 0.05$): indoor with outside run (IN: $n=34$ farms), outdoor (OUT: $n=12$) and partly outdoor (POUT: $n=28$). The hypothesis was that all three systems can deliver good welfare when well managed. Seven trained observers assessed pregnant sows (SO), weaners (WE) and fatteners (FA) using animal-based parameters.

Across systems, the median prevalence of several AHW problems was 0% (shoulder lesions SO; ectoparasites SO, FA; tail lesions and lameness WE; runts FA). Also no differences between husbandry systems in the prevalence of vulva deformation in SO (10.7%, 3.0%, 8.7%); short tails in WE (0%, 0.5%, 2.2%) or in FA (1.8%, 2.3%, 6.5%).

OUT had lower prevalence of respiratory problems in WE and FA (both 0% OUT, >60% POUT, IN). Signs of diarrhoea in WE were less frequent in OUT (0%) than in IN (25.0%), and diarrhoea in FA was less frequent in OUT than in POUT and IN (0%, 0%, 8.3%). OUT had fewer lame sows than POUT and IN (0%, 3.4%, 7.1%).

The results showed that, across systems, prevalences of most AHW areas but respiratory problems in IN and POUT and diarrhoea in IN were low. Beyond that, OUT appeared to be beneficial with regard to several areas of AHW, which could be explained by the environmental conditions, e.g. respiratory problems (air quality), diarrhoea (exposure to faeces) and lameness (flooring). POUT farms in most cases kept SO outdoors and WE and FA similar to IN farms, and this was reflected in the results obtained for these animal categories. It can be concluded, that systems do differ regarding AHW. Therefore AHW benchmarking should consider the husbandry system.

INTEGRATING PIG WELFARE OUTCOMES INTO FARM ASSURANCE SCHEMES

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Welfare outcome assessments (WOA) are a vital aspect of welfare assurance for farm assurance schemes as they provide an objective level of detail about the welfare of the animals on farm that more conventional resource based audits are unable to supply. The AssureWel project is a unique collaboration between the RSPCA, Soil Association and University of Bristol with a primary objective of producing robust and practical WOAs for the major terrestrial farmed species. WOAs have been developed and embedded within the project partners' respective schemes (Soil Association Certification (SA) and RSPCA Freedom Food (FF)) since 2011 for laying hens and 2013 for dairy cattle. The project also promotes the inclusion of WOA to other farm assurance schemes both nationally and internationally.

The AssureWel project implemented WOA for dry sows and finishing pigs within the FF and SA farm assurance schemes in 2014. The assessment measures were determined via literature reviews, consultation with welfare experts and the industry. Sixteen measures and scoring protocols were agreed upon. WOA measures were developed for individual animals (e.g. lameness) as well as at a herd level (e.g. hospital pen), and include measures for positive behaviour, (e.g. utilisation of enrichment) and the results of negative behaviour, (e.g. tail lesions). After an initial piloting phase to trial the WOA protocol, assurance scheme assessors and field staff for both SA and FF were trained and standardised in the AssureWel WOA measures. Data is collected from a maximum of 50 randomly sampled pigs per farm during routine annual farm assurance assessment visits.

Data is currently being collated and will be used to benchmark farms, stimulate discussions between farmers and assessors aimed at encouraging behaviour change to improve welfare and to improve scheme standards as part of a continual improvement process. These AssureWel methods have already been shown to improve welfare in UK laying hens.

DANISH PRODUCT STANDARD

By Asger Kjær Nielsen, Quality Manager-DANISH at SEGES, Pig Research Centre (PRC)

DANISH Product Standard (DPS) is a third part EN17065 accredited quality assurance scheme that defines the requirements for the production of pigs exported to Germany or delivered to any Danish slaughterhouse with export of pig meat. Key areas are animal welfare, meat safety and traceability.

DPS is owned by PRC and was launched in 2007 due to requirements from customers world wide. Today DPS is accepted by the German 'QS', and with a few extra points in it, there is a UK version of the standard fulfilling requirements from the UK market.

The frequency of audits is every third year but partly risk based. If producers have some non compliance in relation with animal welfare, they have the risk of getting a new audit within a year. The frequency of audits at "UK-producers" is once a year.

More than 150 points are checked by the auditor during an audit. The auditor are special educated and the certification body are accredited by DANAK.

In 2014 2,060 audits were made under DPS and 1,149 UK-audits were made. In order to secure that the pig producers are improving in areas relates to animal welfare, PRC makes quantifications on special selected points once a year. For example 'pigs who should have been treated'. In Q2 2014 there was non compliance regarding that point in 7.8 pct. of all audits (17.7 pct. in 2013). When we count the number of pigs behind this figure we find 127 pigs. And with 1,484,450 pigs audited in Q2 2014 this is equal to 0.08 permille, or 8 out of 100,000 pigs, 'who should have been treated'. The same number in Q2 2013 was 19 out of 100,000.

THE PROFILE OF ITALIAN CONSUMERS OF ANIMAL-FRIENDLY FOODS

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Increased awareness of European citizen towards animal welfare, encouraged the development of policies aimed to improve the living conditions of the farmed animals. To increase consumers' awareness and reduce information distortion, the hypothesis of a common European label based upon a unique welfare certification scheme is presently under investigation.

The implementation of animal welfare policies involves an economic effort by farmers. Such costs need to be acknowledged by the market. Otherwise, the risk would be an increase of the production costs for European farmers without a parallel increase in the consumers' awareness.

Our research is based on 335 consumer interviews, conducted near and within supermarkets and hypermarkets in Bologna (North-Italy) and in its province. In order to get information on consumers' knowledge of farming conditions and understand how their perception can influence the consumption behavior of "animal friendly" products a cluster analysis was conducted.

The effects that direct cognition attained through farm visits had on consumers' perception of animal welfare also differed across different species. In particular, most consumers (50%) had visited cattle farms, and this experience contributed to improving their perception of cattle welfare. Only 5% of consumers had visited an intensive swine farms but the visit didn't not modify their perception of swine welfare.

Cluster analysis identified four homogenous groups of consumers (clusters) defined by the variables considered most representative in the explanation of the phenomena investigated. Groups were called: 1) "Sensible and aware consumers" (36%); 2) "Disinterested consumers" (36%); 3) "the experts" (6%) and 4) "unconcerned consumers" (25%).

The first group represents an important market segment for "animal friendly" products. Therefore, the possibility to recognize the presence of an ethical added value is indispensable both to help the consumer to identify the "animal friendly" products and for raising animal welfare level above the minimum mandatory requirements.

MASTER EDUCATION IN THE ASSESSMENT OF FARM ANIMAL WELFARE – A RECENT DANISH INITIATIVE

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Increasing concern for the welfare of farm animals induces a growing need for documentation and understanding of animal welfare and its measures, and for relevant education

Therefore, Aarhus University, Department of Animal Science, now offers a professional upgrade focusing on farm animal welfare. The two year part time master program in assessment of farm animal welfare has been available since August 2013. The education is given in Danish with required literature mainly in English. The program is modular in structure, and gives 15 ECTS credits for each of the four modules. The program is intended for Scandinavian students, who have a bachelor or master degree with a biological background and with relevant professional work for at least two years.

The master program aims to offer an education to persons, who in their daily life, directly or indirectly, work with animal welfare. The program enables the students to get knowledge and methods to understand definitions and indicators of animal welfare, to know animal welfare ethics and the biology behind the law on a national and international level, as well as to demonstrate and understand how assessment of animal welfare can be applied in practice.

In addition the ability to plan strategies for communication of animal welfare with different stakeholders are included as a general learning outcome.

The first group of students will finish the master in June 2015 and a second group has started the education in August 2014. The participants have mainly been private veterinarians, veterinarians employed by authorities or by NGOs, advisors (both veterinarians and agronomists) from the private agricultural organisations and biologists.

For more information:
www.au.dk/dyrevelfærd

A REVIEW OF ENRICHMENT PROVISION IN THE EUROPEAN SUPPLY BASE OF A MAJOR UK RETAILER: ANALYSIS OF COMPLIANCE TRENDS FOLLOWING THE INTRODUCTION OF AGRICULTURAL CODE OF PRACTICE REQUIREMENTS .

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Council Directive 2008/120/EC laying down minimum standards for the protection of pigs represented a significant advancement in approach to environmental management, specifically enrichment provision.

As a legislative requirement compliance was implicit in the Tesco Code of Practice from 2008. However, persistent levels of non-compliance (44% in January 2010) led to the inclusion of a stand-alone inspection clause in 2010, which clearly stipulated that chains alone (historically, a commonly used enrichment device) were no longer acceptable.

The global supply base is inspected by Integra Food Secure Ltd, an independent, ISO 17020 accredited, inspection body. The benefits as a whole being that Integra are a small, welfare -focused team working with Tesco to drive improvements through the supply chain and shape standards.

A total of 607 inspections pig farm inspections were completed across the UK, Ireland and EU (Denmark, Germany, Holland, Italy and Spain) between January 2010 and December 2014. Findings initially demonstrated continued confusion regarding what was acceptable enrichment media (not least following independent assurance scheme inspection where non-malleable objects were still being assessed as appropriate). However, in the intervening period there has been a decrease in non-compliance within the supply base to 25% to the end of 2013 and 17% to the end of 2014. This was accompanied by qualitative benefits i.e. demonstrable improvement in range and type of provision, enhanced understanding at a farm level and increased communication from processors to their supply base (generated as corrective action) to ensure a raised awareness.

PRELIMINARY STUDY OF NON-COMPLIANCE WITH ANIMAL WELFARE LEGISLATION WHEN TRANSPORTING PIGS IN SWEDEN

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It is estimated that the number of pig transports by road in Sweden each year is at least 14,000. The aim of this study was to explore patterns of non-compliance with animal welfare legislation based on data from the Swedish official animal welfare control of these transports from 2010 to 2013. The pig transport checklist used by inspectors consisted of 14 animal welfare checkpoints concerning space allowance, fitness for transport, means of transport, transport practices, additional provisions for long journeys, watering, feeding, transport time and resting periods. Prevalence of non-compliance with each checkpoint was summarised across year and control type (reason for inspection). During the study period there were 195 inspections of 124 registered animal transporters, conducted in 17 different counties. Of the 2730 potential records, only 768 (28%) checkpoints were controlled, 1223 (45%) were noted as being not applicable and 739 (27%) were not controlled. Of all transporters, 95 were inspected once, 28 between 2 to 6 times and one transporter was inspected 23 times. The median number of pigs per transport was 110 (interquartile range 65 to 180). The control types were directional (directed towards e.g. a specific animal category; 87%), risk-based (5.6%), random (7.2%), or justified by a complaint (0.5%). At 27 (14%) of the inspections, at least one non-compliance was found concerning too little space (10 records), no use of driving boards (9), too large group size for fattening pigs (5), too large group size or inappropriate bedding for piglets (1), inadequate mechanical ventilation (3), and no access to water (3), or totally 4.0% of all controlled records. Further analysis of these data is required to identify associations between risk factors and animal welfare outcomes, taking into consideration the high prevalence of checkpoints that were not controlled.

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VALIDATION ON-LINE SLAUGHTER CHECKS AS A PIG WELFARE DIAGNOSTIC TOOL

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Meat Inspection (MI) is carried out primarily to safeguard human health by preventing unfit meat products from entering the food chain while also identifying any diseases that may prove harmful to humans and animals. The output-based nature of MI makes it a good candidate for use as an animal welfare assessment tool. Furthermore, the adjusting of an established pre-existing system such as MI may be more practicable than developing lengthy on-farm welfare assessments. The aim of this study was to determine whether lifetime welfare is reflected in additional welfare-oriented MI measures taken from the carcass and is relevant for presentation at this conference as it involved exploration of the *use of animal welfare indicators to improve animal welfare*. 10 batches of pigs (N = 720) kept in conventional intensive housing conditions were assessed for tail lesions, skin lesions and a number of health issues (e.g. lameness, bursitis and coughing) at 7, 9, 10, 15 and 20 weeks of age. Post-mortem, each pig was then scored for tail length, tail lesions, loin bruising and fresh (red) and old (non-red) skin lesions. The carcasses of pigs deemed to have poor welfare in life (Experimental [E] pigs) were compared to those deemed to have good welfare (Control [C] pigs). E pigs had significantly shorter tails ($P < 0.001$), significantly more severe tail lesions ($P < 0.001$) and significantly more healed (non-red) skin lesions on the carcass ($P = 0.001$) than C pigs. These findings suggest that evidence of welfare lesions occurring on farm remain evident on the carcass. Therefore, integration of welfare measures into routine MI has the potential to reflect the welfare standards animals are exposed to on their farms of origin.

A COMPARISON OF LESIONS FOUND DURING MEAT INSPECTION OF FINISHING PIGS RAISED UNDER ORGANIC/FREE-RANGE CONDITIONS AND CONVENTIONAL INDOOR CONDITIONS

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It is often argued that pigs raised under less intensive production conditions have a higher level of animal welfare than that of conventionally raised pigs. The aim of this study was to compare the health, at the time of slaughter, of finishing pigs raised in organic or free-range production systems with the health of finishing pigs raised under conventional conditions. Meat inspection findings were used as an indicator of health.

Meat inspection data from 201,160 organic/free-range pigs and 1,173,213 conventionally raised pigs slaughtered at one abattoir during a period of one year were used for the analysis. The prevalence of each individual type of lesion in organic/free-range pigs was compared with the prevalence in conventional pigs. Because of the large amount of data, a significance level of 0.001 was used, and only odds ratios greater than 1.2 or less than 0.8 were considered to be of significance.

A total of 13 lesion types were more frequent among organic/free-range pigs than among conventional pigs, including healed rib fracture (OR=3.8), tail lesion (OR=3.2), chronic infectious arthritis (OR=3.2), old fracture (OR=2.2), osteomyelitis (OR=2.1) and chronic peritonitis (OR=1.5). Four lesion types were equally frequent: chronic pneumonia, chronic pleuritis, fresh fracture, and abscess in head/ear. Four lesion types were less frequent among organic/free-range pigs, including abscess in leg/toe (OR=0.7), hernia (OR=0.7) and scar/hock lesion (OR=0.4).

We suggest that the higher prevalence of a number of lesions observed during meat inspection of organic/free-range pigs can be linked to: 1) a higher level of tail biting, 2) limited batch management and poorer hygiene, 3) less antimicrobial treatment, 4) a moist/wet floor in parts of the pen and 5) squeezing by the sow during the suckling period. The results emphasize the importance of using direct animal-based parameters when evaluating animal welfare in different types of production systems.

SHOULDER LESIONS IN NORWEGIAN SOWS AT SLAUGHTER

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Shoulder lesions in sows is one of the main challenges for sow welfare in Norwegian pig production. Earlier studies showed that the incidence increased from 10.1 % to 21.3 % from 2004 to 2008, all grades included. Since then, great effort has been made to inform producers about preventive measures, and shoulder lesions has been included in the breeding goal since 2010. The objective of the survey was to estimate the prevalence of shoulder lesions in Norwegian sows at slaughter and to evaluate the effect of measures undertaken to reduce the prevalence.

A total of 2287 sows were examined at 13 different abattoirs. The Norwegian Food Safety Authority performed the examinations. The following grading scale was used: 0=healthy skin, 1=initial stage (swelling or reddening), 2=moderate skin lesion, 3=serious lesion, 4=very serious lesion. Size (small, medium, large) and body condition (thin, medium, fat) of the sows were also recorded. Skin deviations were recorded in 21.9 % of the sows. 13.6 % of the sows had grade 1, 5 % had grade 2, while 3.3 % had grade 3 or 4. The prevalence varied between the abattoirs.

Size of the sows and body condition were identified as risk factors for shoulder lesions. For sows that were both large and thin, skin lesions were recorded in 58.5 % of the sows and 12.2 % had shoulder lesions grade 3 or 4.

Compared to the results of the survey from 2008, there has been a reduction in shoulder lesions grade 3 and 4, while there has been an increase in shoulder lesions grade 1. This may partly be a result of more strict classification, with inclusion of skin lesions as reddening and swelling in grade 1. However, the results show that shoulder lesions is still a serious welfare problem in Norwegian pig production.

FEMALE AND MALE PIGS' PERFORMANCE IN A JUDGMENT BIAS TASK

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Common husbandry practices in industrialized pig farming may compromise the welfare of pigs kept for meat production. This is an incentive to develop and use valid instruments for assessing pigs' welfare. One such instrument is the judgment bias task, which is assumed to provide a measure of affective state. Judgment bias tasks are based on the notion that an animal's current affective state influences its judgment of ambiguous stimuli, e.g. a negative affective state will produce a pessimistic judgment of an ambiguous stimulus. Judgment bias tasks have previously been applied to pigs of both sexes, without systematically addressing possible sex effects. These studies produced mixed results, warranting further investigation of pigs' baseline performance in judgment bias tasks. The present study compared the performance of ten female and ten male pigs, socially housed in an enriched environment, in an active choice judgment bias task.

Pigs were trained to associate a 'positive' tone-cue with a large food reward, available in a designated goal-box. A 'negative' tone-cue was associated with a smaller food reward in another goal-box. After completing training on these tone-cues, pigs were presented with three different ambiguous tone-cues with frequencies between the two previously used tones. Approaches to the 'positive' or 'negative' goal-boxes in response to ambiguous tones were recorded as optimistic or pessimistic responses.

Both females and males displayed a slightly optimistic judgment bias. This low level of optimism in spite of (social) enrichment could have been caused by a decrease in optimistic responses as testing progressed. The pigs may have learned about the unrewarded outcome of ambiguous cues, rendering these tone-cues no longer ambiguous, but predicting a negative outcome (no reward). Loss of ambiguity could lead to incorrect conclusions about the pigs' affective state. Further improvement of the judgment bias task as a welfare indicator is deemed necessary.

FEMALE PIGS DO NOT GET BULLIED WHEN PENNED TOGETHER WITH ENTIRE MALE PIGS DURING THE FATTENING PERIOD

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There were concerns raised that penning females together with entire males might impair their welfare compared to mixed-sex groups with castrated males. On a commercial organic farm we compared mixed-sex groups with entire males and females (EF) to mixed-sex groups with castrated males and females (CF) during the fattening period. Groups consisted of 10 male and 10 female animals and were repeated six times. At five occasions (observation day 4, 27, 51, 78, and 110) all animals were inspected for skin lesions and behaviour was observed. Focal animals were all male animals. Identity of actor and recipient of behaviours was recorded.

In general, entire males showed significantly more agonistic interactions (head knocking/biting and fighting) compared to castrated males ($c2(1) = 15.5$, $p < 0.001$ and $c2(1) = 18.1$, $p < 0.001$) and also more mounting ($c2(1) = 12.0$, $p < 0.001$). Entire males directed agonistic interactions mainly towards other entire males rather than towards females. Entire males performed 71% of total head knocks/bites towards other males, while castrated males nearly equally performed interactions towards males and females (47% towards males; $c2(1) = 17.1$, $p < 0.001$). Nevertheless, in terms of total received head knocks/bites, females in EF groups had a tendency to receive more than those in CF groups ($c2(1) = 3.0$, $p = 0.09$) due to the overall increased occurrence of agonistic interactions in entire males. Female pigs in EF groups did not have more skin lesions than those in CF groups ($c2(1) = 1.0$, $p = 0.3$).

Our results suggest that also under enriched (organic) housing conditions, entire males show more aggressive behaviour than castrated males. However, they interacted clearly more often with other entire males. Together with the finding that females did not have more skin lesions when penned together with entire males, our study implies that welfare of female pigs is not impaired in mixed-sex groups with entire males.

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STARTLING PIGS - A POTENTIAL WELFARE MEASURE?

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A truly accurate assessment of on-farm welfare requires validated proxy measures of animal affective states. In both humans and rodents, the 'Defence Cascade' (DC) response to a startling stimulus has been shown to reflect affective state. We investigated whether the same applies to pigs and therefore whether the DC response is a potential on-farm measure of pig welfare.

Twelve groups of four pigs were placed in neutral housing (low level straw / shavings, two chains, predictable lighting / feeding). Ten days later half the pens were converted into 'Barren' (shavings only, one chain, minimal human interactions, unpredictable lighting / feeding) and the other half to 'Enriched' (daily straw, increased enrichment, positive human interactions, predictable lighting / feeding). After six weeks, the treatments were switched. In week 3 of each environment 'Initial' DC sessions were completed; the pigs were filmed in their home pen whilst a startling stimulus was applied three times. In weeks four to six drugs (Diazepam, Reboxetine or Control) were given orally to each group prior to DC testing, balancing order across groups. Each pigs' startle magnitudes were rated on a scale from 0 (no reaction) to 4 (flee from stimulus) by a trained observer.

A multilevel model was used to account for the data structure. Both Normal (ease of model comparison) and Ordered Multinomial (better accounting for ordinal measure) responses were considered, only factors significant in both are presented. Initial univariable analyses indicate a decreased magnitude of startle was associated with 'Barren' housing ($p < 0.0005$). Startle magnitude was higher in 'Initial' tests but lower in 'Reboxetine' than in the 'Control' treatment ($p < 0.0001$). Startle responses were smaller in lying pigs compared to *standing* ($p < 0.0001$). Pigs that were exploring or alert startled more than *inactive pigs* ($p < 0.0001$). Further analysis exploring interactions and other measures of affective state will be presented.

MEASURING COPING STYLE ON A CONTINUOUS SCALE AND ITS RELATION TO AGGRESSION AT MIXING IN WEANED PIGS

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Coping styles are a set of correlated behavioural and physiological responses to environmental stressors that are consistent over time and across situations within an individual. However, whether a pigs' coping style can be classified categorically as either proactive or reactive, or reflects a continuum is unknown. Aggression at mixing poses a significant welfare problem and the ability to predict aggressive behaviour in individuals could lead to improved measures to reduce its occurrence. We investigated whether pig behaviour in response to mildly stressful situations can be expressed on a continuous scale from proactive to reactive coping style. Furthermore, we tested whether individual score on this scale was related to aggression at mixing. A total of 60 commercial crossbreed (PIC 337 x (Large White x Landrace)) pigs were tested in 3 replicates. Individual behaviour was recorded in two repeated social isolation tests and in two repeated novel object tests. Post-weaning aggression at mixing was recorded for 150 minutes over two days. Several behaviours were found to be repeatable and highly correlated; these were aggregated to create the continuous coping style scale. Individuals at the proactive end of the scale were more vocal, quicker to contact a novel object and spent longer standing alert. Individuals at the reactive end of the scale were less vocal, took longer to contact a novel object and spent more time exploring the arena. Individual score on this scale was found to be significantly related to total time spent fighting, with more proactive pigs spending longer fighting than more reactive pigs. These results suggest that coping style in pigs may be measured on a continuous scale and that an individual's score on this scale is predictive of aggression when pigs are mixed at weaning.

WHAT ARE YOU LOOKING AT: DIFFERENCES AND SIMILARITIES BETWEEN STAKEHOLDERS IN ASSESSING PIGS

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Pig welfare is a topic that concerns us all. However, although we all agree that pigs are entitled to be treated well, different stakeholder groups do not seem to agree in the way how that should be accomplished. This latter may be explained by possible differences in their frame of reference (as constructed by a person's norms, values, knowledge, convictions and interests). Therefore, the objective of this study was to investigate whether different stakeholder groups would assess pigs differently and whether that is related to differences in their frame of reference. Hereto, three stakeholder groups were selected of which two were classified as expert stakeholders, i.e. pig farmers (n=11) and pig scientists (n=18), and the other as lay-group, i.e. urban citizens (n=15). Stakeholders were asked to perform a qualitative behaviour assessment (QBA) in which they observed a pig in nine different videos and assigned a score to each video using 21 predefined terms such as 'happy' or 'irritated'. In addition, stakeholders filled out two questionnaires in order to obtain information on their frame of reference. The QBA was analysed using principal component analysis and showed that the pig farmers had a more rosy view of the pigs than the urban citizens and pig scientists. This was evident from the consistently higher scores given by the farmers on the positive terms used to score the videos ($P \leq 0.001$). Furthermore, the questionnaires revealed that the stakeholders had a different frame of reference regarding pigs and a different understanding of welfare. For instance, rolling in mud was regarded more important to a pig's happiness by the scientists and urban citizens than the farmers ($P < 0.01$). In conclusion, differences in frame of reference may thus underlie differences in stakeholders' view of pig welfare and that may consequently hamper the discussion on how to improve it.

HOW TO SOLVE A CONFLICT WITHOUT GETTING INTO A FIGHT

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Excessive aggression is an important welfare issue in pig husbandry and mainly occurs when unfamiliar pigs meet. In natural settings the agonistic behaviour of pigs comprises various threat displays, to which withdrawal may follow. In this way, dominance relationships can be established and maintained without escalation. Commercial housing may impede this process and consequently provoke escalated fighting. We studied the importance of the full expression of agonistic behaviours on the time and strategy to settle conflicts. Contests ($n=52$) were staged between unfamiliar pairs of pigs (M/F) of similar age (10 wk) and body weight, in an arena measuring 2.9×3.8 m. Contests lasted until a clear winner was present (max 30min). Behaviour was observed from video. Contests lasted on average $5\frac{1}{2}$ min (339 ± 19 s) with 87 ± 6 s of the contest spent on display behaviour (e.g. parallel walking), 35 ± 6 s on pushing, and 54 ± 6 s on mutual fighting. Pairs showing more display behaviour had a longer contest duration ($b=2.4 \pm 0.3$ s/sec display; $P<0.001$), but did not differ regarding fight duration ($P=0.96$). In 28% of contests, pigs reached an outcome (winner/loser) without fighting. In these contests there was 53% more non-damaging investigation of each other ($P=0.06$), 46% more parallel walking ($P=0.01$), and 64% less pushing ($P=0.04$). However, bullying increased 2.8 fold in contests without a fight ($P<0.001$), which might be due to more energy reserves or a heightened need to affirm the outcome. Pigs which invest more time in display behaviour, and are given the space to do so, seem able to resolve conflicts without escalated mutual fighting. Negative consequences of fighting which may impair welfare and productivity (e.g. skin lesions, injuries, reduced food intake, increased energy expenditure) might be reduced when pigs are given more opportunity to signal their intent. Space for conflict resolution should therefore not be regarded as an unnecessary luxury.

EFFECT OF REMOVAL OF IN-FEED ANTIBIOTICS ON SKIN LESION SCORES OF PIGS DURING THE 1ST AND 2ND WEANING STAGES

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The aim of this study was to evaluate effects on skin lesion scores of removing antibiotics (AB) from the feed of 1st and 2nd stage weaner pigs. The study was conducted on a commercial farrow-to-finish farm (300 sows) with a programme of in-feed AB treatment. Every week for 6wks 70 pigs were weaned at 28 ± 2 d of age, weighed, tagged and sorted into 2 groups of approximately 35 pigs according to weight (10.6 ± 0.7 kg). AB were removed from the diet of one group (NO, n=6) and maintained in the other group (ANTI, n=6). Ten focal pigs were chosen per group. At the end of the 1st stage (4 wks and 4 d) each group was split into two pens of c. 15 pigs each in the 2nd stage (NO, n=12 and ANTI, n=12) for a further 4 wks and 3 d. Data were recorded on a weekly basis for 9 wks. Skin lesions were scored on the focal animals according to severity; body (BL, 0 to 6), tail (TL, 0 to 5), ear (EL, 0 to 3) and flank (FL, 0 to 3). Data were analysed using SAS 9.3. The BL score tended to be higher in ANTI than in NO pigs during both stages (10.88 ± 0.92 vs. 9.43 ± 0.92 ; $P=0.09$ and 18.81 ± 0.83 vs. 16.62 ± 0.83 ; $P=0.07$). Treatment had no significant effect on the EL, FL and TL scores ($P>0.05$). There were significant changes in all of the lesion scores across time ($P<0.05$). As expected, removing antibiotics from the feed of pigs had no effect on skin lesions related to pig welfare.

A WELFARE-FRIENDLY SAMPLING METHOD FOR GROUP-HOUSED GESTATING SOWS

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Blood, usually used as diagnosis fluid for sows, is sampled according to an invasive method which can stress and hurt the animal. Furthermore, the sampling requires at least two trained operators. This study aimed at assessing the feasibility of oral fluid (OF) sampling on a chewing device, already used in growing pigs, as an alternative to blood sampling in group-housed gestating sows. The study was carried out in 30 French herds (1359 sows) selected on the gestation housing type (straw bedding vs. slatted floor). In each herd, individual OF and blood samples were taken from at least 30 sows and three pens selected at random. From these pens, pen-based OF samples were collected on a chewing device provided for 45 minutes. Sampling and chewing times per sow and OF quantity were recorded for each sample. Individual information was collected for each sow. Every 15 minutes, the lying sows were counted (to measure the pen activity level). Factors associated with individual sampling time and the probability that a sow chew the pen-based sampling device were identified by logistic regression models. Individual OF sample took 2:50 min (one operator, 4 ml) while blood sample took 1:15 min (at least two operators). Sampling time was significantly higher when straw bedding and varied according to the chewing device design and the operator. 45.8% of the sows from 78.8% pens chewed the pen-based device (49 ml). Sows were less attracted by some kind of collective device, when straw bedding, when multiparous and when the activity of the pen was low. OF sampling is a safe technique easy to perform by a single operator. This is a promising welfare friendly sampling technique for group housed sows based on the animal cooperation. The type of sampling (individual or pen-based) should be adapted according to animal housing.

THE PIG APPEASING PHEROMONE: HOW CHEMICAL COMMUNICATION IMPROVE THE WELFARE OF PIGS

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Stress-related problems are very common in pigs and lead to impaired performances and increased vulnerability to infections at any stage of life of the animal. Since the appeasing pheromone has been identified in pigs, different studies assumed the efficacy of this semiochemical. Indeed, the use of pheromones is a very interesting strategy to improve pig animal welfare.

The goal of this poster is to inventory all the parameters that had been measured on pigs and to highlight the ones which have proved the effectiveness of the Pig Appeasing Pheromone in improving welfare. Data are focused on three categories of indicators: behavioural, zootechnical and physiological.

Several studies have proved the effectiveness in decreasing stress-related behaviours; the PAP is especially effective in reducing aggressions with demonstrating a reduction of the number of fight and a shorter fight duration during the weaning period, the fattening period and the group-housed pregnant sow's period. Some studies showed that the PAP allows to optimize the growth after weaning with an improving of the Daily Weight Gain and the feed gain ratio. Moreover, concerning zootechnical parameters, a study noticed the homogeneity of pigs at slaughter in terms of weight range. Few studies explored the physiological parameters and one of these demonstrated a dramatically inhibited release of salivary cortisol during a social challenge between sows.

PAP is a modulator of the homeostasis of individuals. The appeasing pheromone family, as showed in other mammals' species allow the individual to cope with the environment and facilitate the adaption process.

POTENTIAL USE OF PHYTOTHERAPY TO REDUCE THE STRESS IN PIGS.

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Plants have been used since ancient times in medicine and in veterinary science as palliative or preventive treatments (e.g. astringent, sedative, anti-inflammatory, antiparasitic, blood stimulant, antiseptic, etc.). The aim of this study was to determine whether phytoteraphy could be used to reduce stress in growing pigs. An herbal compost (HC) (Sedafit ESC, Phytosynthèse, Saint-Bonnet de Rochefort, France) containing Valeriana (*Valeriana officinalis*) and Pasiflora (*Passiflora incarnata*), both with sedative effects, was administered to 56 males [(Landrace x Large-white) x Pietrain]). The pigs were randomly divided into 2 groups at the age of 15 weeks. One group was fed with concentrate containing HC (2000 mg/kg) and the other group remained as control. HC was administered during 8 weeks. During the experiment, three hair samples were taken for cortisol analysis: one week before the addition of the HC and one and two months after the start of the treatment. Cortisol levels of the first sample were not significantly different between the treatment groups (13.10 vs. 11.18 pg/mg). One month after starting the treatment, cortisol values were significantly lower compared to basal sample levels in both groups, but there were no differences (p-value) between animals supplemented with HC (5.96 pg/mg) and without (6.56 pg/mg). After two months, pigs with HC presented significantly lower cortisol values (4.37 pg/mg, P=0.038) than animals without HC (7.12 pg/mg). Furthermore, the animals supplemented with HC presented significantly lower cortisol levels (P=0.030) compared to one month after starting the treatment, but these differences did not exist for animals without HC.

In conclusion, this study suggests that valeriana and pasiflora may decrease stress in growing pigs as assessed by hair cortisol if administered over a long period of time. However, further research is required to confirm these preliminary results.

EFFICACY OF AN ANTI-GNRF VACCINE IN SUPPRESSING ESTRUS IN IBERIAN GILTS

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To avoid welfare-, sanitary- and production issues linked to unwanted pregnancies caused by invading wild boar or co-housed males, gilts Iberian pigs were traditionally spayed. However, EU Directive 2008/120/EC restricts this practice. In the present study, vaccination with an anti-GnRF vaccine (Improvac® / Vacsincel®, Zoetis) was tested for its ability to suppress estrus in female pigs reared until an age of 14 months. Sixty 18 week old crossbred (Iberian x Duroc) gilts were randomly allocated to one of three treatment groups (T01, control T02, injected three times with Improvac® and T03, injected four times with Improvac®). From day 1 until day 290 animals were tested for standing estrus in presence of a boar, 3 times per week. Animals were regularly blood sampled to assess serum titers of anti-GnRF antibodies and serum progesterone. At slaughter (day 293-300), the weights of uteri and ovaries and the length of the uterus horn were assessed. Standing estrus was observed in 85% of gilts T01, 15% T02 and 0% T03. In the case of T02, two animals were judged to be in estrus around the time of the 2nd vaccination, with a third animal detected at day 244 of the study. Both T02 and T03 had higher ($P < 0.0001$) serum titers of Anti-GnRF antibodies for all time points sampled except the first, before the first injection. From day 112 after the first vaccination onwards, both T02 and T03 had lower ($P < 0.002$) progesterone levels when compared to T01. At slaughter, the weight of the ovaries was higher and uterus weight and length were smaller and lighter in T01 than in T02 and T03 ($P < 0.0001$). Both the three and four dose regimen of Improvac® reduce estrus and estrus related behavior, and thus provide a promising alternative to surgical castration in Iberian gilts.

STOMACH ULCERS IN LACTATING SOWS ARE NOT ASSOCIATED WITH LOW FEED INTAKE

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A recent Danish investigation of sows at slaughter showed that 51 per cent had ulcers or scars in the esophageal part of the stomach. However, there is scarce information on how stomach ulcers might affect the wellbeing of sows. A reduced feed intake could be an indicator of reduced welfare and it may be assumed to be an indicator of pronounced stomach ulceration or scarring. The aim of this study was to determine whether low/high feed intake could be associated with the stomach health in sows.

The three herds (1,200-1,400 sows) using liquid feeding with daily recordings for the individual sow were included. Low daily feed intake (LOW) was defined as the lowest 20 per cent of the sows within-herd, whereas high daily feed intake (HIGH) was defined as the highest 20 per cent of the sows within-herd. A total of 96 LOW and 96 HIGH sows across the three herds were included. The herd-managers selected sows for culling day 0 to 8 post-weaning. Sows were selected for the study based on season and parity. The esophageal part of the stomachs were inspected visually and palpated by a pathologist.

The pathological changes were described by an index from 0 to 10. Index 0-5: no or minor changes. Index 6-8: degrees of ulcer and/or scar in the pars esophagea. Index 9-10: stenosis of the esophageal lumen. Data was analysed using PROC GLIMMIX in SAS.

The results showed that the probability of having gastric ulcers with an index from 6 to 10 ($P=0.982$) or 8-10 ($P=0.312$) was identical for LOW and HIGH sows. Based on the present data, feed intake cannot be used as a tool for prediction of stomach ulcers in lactating sows.

A CROSS-SECTIONAL STUDY ON THE PREVALENCE AND RISK FACTORS FOR LIMB LESIONS AND LAMENESS IN FINISHER PIGS ON COMMERCIAL FARMS IN IRELAND

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A cross-sectional survey of 68 integrated Irish pig farms was conducted to determine the prevalence and risk factors for limb lesions and lameness in 1289 finisher pigs. One pen of finishers aged 18wks and one pen aged 22wks were examined per farm for limb lesions and locomotory ability. Limb lesions were scored from 0 to 3 based on size. Locomotory ability was scored from 0 to 5 based on severity (score ≥ 2 defined as lame). Materials and dimensions were recorded and a questionnaire conducted. Lesion prevalence was calculated and multilevel mixed effect logistic regression was carried out using MLwiN 2.27 to elucidate risk factors. The prevalence of lesions was: scratches (80.8%), wounds (25.4%), swellings (28.9%), abscesses (0.8%), calluses (99.5%), alopecia (54.6%), bursitis (29.6%) and capped hock (0.8%). The risk of scratches decreased when pigs aged 18w were compared with pigs of 22w (OR 0.69, CI 0.51-0.95). A reduced risk of scratches (OR 0.36, CI 0.20-0.65), wounds (OR 0.59, CI 0.36-0.95) and bursitis (OR 0.60, CI 0.39-0.93) was associated with pigs in partially slatted pens when compared with fully slatted pens. Pigs that were stocked at 0.35- 0.7 m²/pig had an increased risk of scratches (OR 2.38, CI 1.25-4.54) compared to pigs stocked at 0.84-3.04 m²/pig. The prevalence of lameness was 32% and the risk of lameness increased from 18 to 22 weeks (OR 2.38, CI 1.25-4.54). An increased risk of lameness was associated with a slat void of greater than 20 mm compared to less than 20 mm (OR 1.70, CI 1.06-2.73). Additionally pigs in pens washed 4 times a year had a reduced risk of being lame (OR 0.62, CI 0.40-0.98). The high prevalence of limb lesions and lameness in finisher pigs in slatted systems could be partially addressed by changes to housing environment and management practices.

THE ERGONOMY OF BREEDING: AN INNOVATIVE APPROACH TO IMPROVE WELFARE IN PIG PRODUCTION

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In intensive pig production conditions we find animal welfare problems. We need to assess welfare in a practical way, increasing the efficacy of index and taking action to find solutions.

The aim of the ergonomy of breeding is to create optimal and ethical conditions of production, considering the animal as a worker that has to be in the best conditions to obtain the best results. In this method, a multidisciplinary team of experts work to achieve the reconciliation between animal welfare and performance. They use the most recent methods not only to assess animal welfare but also to diagnose and propose to the breeder possible solutions of their problems, to get a better production, a better welfare and a better image.

There are two types of index. The first one, called ErgoBreeding® Quick Assessment, has the objective to give some quick tools to the breeder to evaluate animal welfare in the farm and the support to improve the welfare.

Accessing to the web, the breeder could include the parameters of his farm (regarding environment, health, eco-parameters, behaviour and performance) and obtain a report that propose solutions to solve animal welfare problems. Afterwards, the breeder could repeat the evaluation to verify the improvement.

The second one, called ErgoBreeding® Full Assessment, has the aim of going in depth in the evaluation, stabilizing a high level of welfare and production, increasing a low level or solving some important problems, giving the complete advice of the experts.

This method underlines the importance of the implication of different figures in the evaluation and monitoring of animal welfare, making a diagnosis of a situation and proposing solutions. The animal and the breeder work together and we have to find our welfare to insure an ethical production, economically sustainable and respectful with the species.



WORKSHOPS

1-7

WORKSHOP 1

MORTALITY AND WELFARE IN THE FARROWING UNIT

Purpose of the workshop:

The aim of the workshop will be to identify potentials and focus area for further improvement of piglet survival and welfare of sow and piglets in the farrowing unit.

Organizers:

- Christian Fink Hansen, Associate professor, University of Copenhagen
- Lene Juul Pedersen, Senior researcher, Aarhus University
- Tine Rousing, Senior researcher, Aarhus University
- Karina Nedergaard, Danish Veterinary and Food Administration
- Anne Sofie Grove, Danish Veterinary and Food Administration

Workshop moderator:

- Christian Fink Hansen, Associate professor, University of Copenhagen

Workshop programme

14.40-14.45	Introduction to the Workshop Christian Fink Hansen, Associate professor, University of Copenhagen
THE FARROWING ENVIRONMENT	
14.45-14.53	Developing a Group Housing System for lactating Sows and Their Litters Sofie Van Nieuwamerongen, PhD student, Wageningen University
14.53-15.01	Strategic Use of Straw for Loose Housed Sows at Farrowing Rebecka Westin, Post Doc, University of British Columbia
15.01-15.09	Housing of Farrowing Sows - Effect of Crating on Sow Maternal Behaviour, Physiology and Production Anna Valros, Professor, University of Helsinki
15.09-15.17	Effect of Temporary Confinement of Sows for 4 Days After Farrowing on Sow Behaviour Janni Hales Pedersen, Post Doc, University of Copenhagen
15.17-15.37	Discussions in Plenum
15.37-15.47	Break
NURSING SOWS	
15.47-15.55	Welfare of Nursing Sows and Their Piglets - Results from a Danish Cross-Sectional Study Tine Rousing, Senior Researcher, Aarhus University
15.55-16.03	Behavioural Observations of Milk Let-Downs in Nurse Sows Compared to Ordinary Sows Charlotte Amdi Williams, Post Doc, University of Copenhagen
PIGLET MORTALITY	
16.03-16.11	Piglet Mortality in Danish Organic Herds Lena Rangstrup-Christensen, PhD Student, Aarhus University
16.11-16.19	Piglet Mortality in Loose Housed Systems Janni Hales Pedersen, Post Doc, University of Copenhagen
16.19-16.40	Discussion in Plenum

DEVELOPING A GROUP HOUSING SYSTEM FOR LACTATING SOWS AND THEIR LITTERS

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Group housing of gestating sows has become mandatory in the EU due to welfare concerns about individually confined sows. During lactation, however, most sows are housed in farrowing crates. A multi-suckling (MS) system provides a larger and more complex environment with more possibilities to express natural behaviours. By housing several sows together with their litters, MS-systems can enhance piglet social development and have the potential to stimulate socially facilitated eating behaviour. MS-systems, however, also pose risks including disrupted nursing behaviour and increased piglet mortality. Thus, MS-systems can provide both advantages and disadvantages for sow and piglet welfare. In the Netherlands, a new MS-system for five sows and their litters has been developed, in which sows can move freely and piglets can enter the communal area after 1 week of age. The system includes a communal floor-feeding area where piglets can learn to eat from the sows. MS-raised piglets showed indicators of improved pre- and post-weaning development. Pre-weaning mortality, particularly before mixing litters, was however an issue that needed attention. In a new version of the system, this issue will be addressed. In addition, in future experiments we will investigate performance of sows and piglets during a 9-week lactation period in which a more gradual weaning process is stimulated using intermittent-suckling.

STRATEGIC USE OF STRAW FOR LOOSE HOUSED SOWS AT FARROWING

Rebecka Westin, DVM PhD, University of British Columbia

A method for “strategic use of straw at farrowing” has been developed by Swedish piglet producing farmers in order to satisfy sows’ behavioural need to nest-build and to provide a suitable environment for new-born piglets. Two days prior to their expected farrowing, sows are given 15–20 kg of chopped straw. The straw is then left to gradually filter through the slatted floor. If the quantity of straw reduces too quickly before farrowing, additional straw is provided to cover visible floor areas. Otherwise no straw is provided until 4-5 days after farrowing. If the straw chop lengths are adjusted to the type and design of the slatted floor most of the straw will have disappeared by this time (1). Thereafter small amounts of straw are given each day in accordance with common Swedish management routines.

The effects of this practice on sow behaviour and piglet health and production have been studied in a large research project. Sows started to nest-build earlier and performed more nest building behaviour compared to when only 2 kg of chopped straw was provided for nest-building (2). The proportion of stillborn piglets was reduced by 27 %. Overall mortality of live-born piglets was not affected but the number of piglets dying due to starvation was substantially reduced (3). Piglet growth was positively affected with +0.3 kg at weaning (4). Economic calculations show that “strategic use of straw” is profitable (5).

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HOUSING OF FARROWING SOWS – EFFECT OF CRATING ON SOW MATERNAL BEHAVIOUR, PHYSIOLOGY AND PRODUCTION

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Most sows within modern piglet production are crated around farrowing. The reason for this is that it reduces space requirement and labour, as well as is thought to reduce piglet crushing. However, studies indicate that total piglet mortality is not reduced in crate vs pen farrowing systems. Sows have a hormonally induced need to build a nest prior to parturition. During the nest building period sows show an increased general activity, as well as diverse substrate-directed behaviours, when possible. Crating the sow during the periparturient period has been shown to cause stress to the sow. Even though sows, independent of farrowing system, show nest building behaviour, crating reduces actual nest building activity, while increasing the occurrence of redirected bar biting. Furthermore, crating reduces oxytocin and increases farrowing duration, which, in turn, is linked to an increased stillbirth rate. The importance of housing during the nest building period is further indicated by the fact that prepartum crating had implications for sow maternal abilities and piglet performance even when sows were confined in crates at the beginning of farrowing : Sows that were crated prefarrowing showed less efficient nursing behaviour, as well as reduced maternal characteristics when compared to sows housed freely in pens. Also piglet growth is improved in non-crated systems, possibly due to improved milk production. Allowing for even more diverse nest building behaviour, by adding more nest building materials to penned sows, further increases maternal hormonal and metabolic status, piglet immune status and piglet growth.

EFFECTS OF TEMPORARY CONFINEMENT OF SOWS FOR 4 DAYS AFTER FARROWING ON SOW BEHAVIOUR

J. Hales¹, V.A. Moustsen² M.B.F. Nielsen² and C.F. Hansen¹

¹Department of Large Animal Sciences, University of Copenhagen, Denmark;

²SEGES, Danish Pig Research Centre, Denmark.

This study aimed at investigating if confinement for 4 days after farrowing influenced sow behaviour. The study was conducted in a Danish piggery with SWAP (Sow Welfare And Piglet protection) farrowing pens. Sows were randomly allocated to one of three treatments: loose-loose (LL: loose from placement in the farrowing unit to weaning; n=48), loose-confined (LC: loose from entry to end of farrowing and confined to day 4 post farrowing; n=50), and confined-confined (CC: confined from day 114 of gestation to day 4 post farrowing; n=45). All sows were loose housed from day 4 to weaning. Behavioural registrations were obtained from video recordings. Regardless of treatment, sow behaviour was characterised by low frequency of postural changes (<12 postural changes in two hour bouts) and a large proportion of time spent in lateral recumbency (80-120 min of two hour bouts), especially day 1 and 2 post farrowing. Postural changes increased during the day in all treatments but more so in LL than LC and CC (P=0.02). Rolling frequency increased from day 1 to day 3 post farrowing in all treatments, but LL had a greater increase than LC and CC (P<0.001). Time spent lying lateral was similar across treatments (P=0.66). Sows in LL had more nursings than sows in CC on day 1, 2 and 3 (P<0.05) and sows in LL terminated more nursings than sows in LC and CC on day 3 (P≤0.001). In conclusion the results suggested that confinement for 4 days after farrowing had little influence on sow behaviour.

WELFARE OF NURSING SOWS AND THEIR PIGLETS - RESULTS FROM A DANISH CROSS-SECTIONAL STUDY

Tine Rousing , Jan Tind Sørensen, Anne Braad Kudahl & Lene Juul Pedersen
Department of Animal Science, Aarhus University

Many sows give birth to more piglets than they can foster themselves. This has in Denmark led to an introduction of nursing sows fostering the surplus piglets. A nursing sow is a lactating sow fostering other sows piglets, after weaning its own piglets and therefore having a longer lactation fixed in a farrowing crate. A cohort of nursing and non-nursing sows and their litters were clinically examined in a cross-sectional study in 59 Danish commercial sow herds. The clinical examination on sows included: bursa on legs, bi-claw wounds, vulva lesions, skin hygiene, skin condition, shoulder ulcers, and wounds on the udder and for the piglets: huddling, skin hygiene, lameness, snout lesions and carpal abrasions. It was found that the prevalence of bursa on legs as well as wounds on the udder was higher for nursing sows than non-nursing sows. Furthermore, an indication of a higher risk of skin lesions for nursing sows compared to non-nursing sows was found. Nursing sow fostered litters had compared to non-nursing sow litters more often carpal abrasions and were more often dirty. Also nursing-sow litters as well showed a tendency of having a higher risk of lameness than non-nursing sow litters of the same age. The differences between nursing and non-nursing sows were tested with a logistic model taking into account effects of age of the litter. Our results indicate that nursing sows and their piglets may have impaired welfare.

BEHAVIOURAL OBSERVATIONS OF MILK LET-DOWNS IN NURSE SOWS COMPARED TO ORDINARY SOWS

Charlotte Amdi Williams, University of Copenhagen

Nurse sows are used in piggeries with hyper-prolific sows to manage large litters. It is not known if nurse sows have altered behavior measured as milk let-downs when they 1) receive new piglets (short-term behavior) or 2) have to stay in farrowing crates beyond the normal weaning time (long-term behavior) compared to ordinary sows (OSOW) weaning their piglets at d25. In Denmark, cascade fostering using two lactating sows are normally performed. The first nurse sow (NURSE1) has her piglets removed after a week and receives surplus newborn piglets that she fosters until weaning. The second nurse sow (NURSE2) weans her litter after 21 days and receives the litter from NURSE1 which she rears until weaning. In total 60 sows (n=20) were randomly allocated to become an OSOW, NURSE1 or NURSE2. Video cameras were placed above the sows. There was no difference in amount of successful milk letdowns on the day the NURSE1 sow received new piglets compared to the OSOW ($P>0.05$). The average successful milk letdowns on the day after NURSE1 sows received new piglets was 1.3 letdowns/h for OSOWS and 1.3 letdowns/h for NURSE1 sows ($P>0.05$). Similar observations were made for NURSE2 sows when they received new piglets after 21 days. The average milk let-down was 1.8 for OSOWs at day 24, 1.6 for NURSE1 sows at day 31 and 1.9 for NURSE2 sows at day 38. In conclusion, no difference was found in the short-term or long-term bouts of milk let-down of nurse sows compared to ordinary sows.

PIGLET MORTALITY IN DANISH ORGANIC HERDS

Lena Rangstrup-Christensen, Lene Juul Pedersen and Jan Tind Sørensen
Aarhus University – Department of Animal Science, Tjele, Denmark

The high piglet mortality in Danish organic sow herds is seen as a key constraint in achieving its potential importance, since consumers expect a high level of animal welfare in organic pig production. This problem is addressed in a PhD study conducted at Aarhus University in collaboration with nine large Danish organic pig herds running from June 2014 until June 2015. The aim of the study is to identify major risk factors, related to sow, litter, season and management, for piglet mortality in Danish organic pig production. The projects two major focus areas are; detailed farm mortality registrations conducted by the farmer and necropsies on a random sample of piglets from each farm in all seasons conducted by first author. The first preliminary descriptive results from the necropsies performed on 1001 piglets collected on the nine farms during the summer of 2014 show that the majority of the piglets, 25% to 52%, were crushed, 13% to 33% were stillborn and 2% to 10% died of hunger. The majority of the stillborn piglets died during the farrowing. The herd level pre weaning mortality rates during the critical warm season, from June 2014 until August 2014 were between 22% and 38%. The herd level proportion of still-born out of total born piglets ranged between 6% and 12%. The average litter size from the same period ranged from 14.70 to 17.62 and the average number of still-born per litter ranged from 0.94 to 2.05.

PIGLET MORTALITY IN LOOSE HOUSED SYSTEMS

J. Hales¹, V.A. Moustsen², M.B.F. Nielsen² and C.F. Hansen¹

¹Department of Large Animal Sciences, University of Copenhagen, Denmark;

²SEGES, Danish Pig Research Centre, Denmark.

For loose housed farrowing systems to be an alternative to traditional farrowing crates, they must deliver production results that are comparable to crates. Piglet mortality was studied in three commercial Danish piggeries with free farrowing pens (FF-pens) and farrowing crates in the farrowing unit. Results showed that piglet mortality in FF-pens was higher than in crates ($P<0.001$) before litter equalisation. Similarly, mortality was higher in pens compared with crates after equalisation, but the difference was dissimilar in the three herds ($P<0.05$). These results suggested that FF-pens were not a robust type of farrowing system. Consequently, the SWAP pen (Sow Welfare And Piglet protection), where sows could be confined for a short period of time around farrowing, was developed. Piglet mortality in this system was studied in a Danish piggery where records were obtained from 2,139 farrowings. Sows were randomly allocated to one of three treatments: loose-loose (LL: loose from placement in the farrowing unit to weaning), loose-confined (LC: loose from entry to end of farrowing and confined to day 4 post farrowing), and confined-confined (CC: confined from day 114 of gestation to day 4 post farrowing). All sows were loose housed from day 4 to weaning. Compared to LL, confinement reduced piglet mortality from litter equalization to day 4, but more so in CC than in LC. Total piglet mortality was greater in LL (26.0%) and LC (25.4%) compared to CC (22.1%) ($P<0.001$). In conclusion, confinement for 4 days after farrowing reduced mortality in this period, but confinement before farrowing was necessary to reduce total piglet mortality.

WORKSHOP 2

CASTRATION OF PIGLETS

Purpose of the workshop

The starting point for this workshop will be the European Declaration on alternatives to surgical castration of pigs. However, also challenges in relation to surgical castration with anaesthesia will be dealt with. Short presentations of the current state of play for the different alternatives will be followed by a discussion aimed at drawing up conclusions on the way forward.

Organizers

- Rikke Thomsen, MSc, Aarhus University
- Birte Broberg, Senior Veterinary Officer, Danish Veterinary and Food Administration

Workshop moderator

- Rikke Thomsen, MSc, Aarhus University
- Birte Broberg, Senior Veterinary Officer, Danish Veterinary and Food Administration

Workshop programme

14:40-14:45	Introduction to the Workshop Rikke Thomsen and Birte Broberg
14:45-14:55	Surgical Castration with Local Anaesthesia Monika Löfstedt, DVM, PhD, Farm & Animal Health
14:55-15:05	Production of Entire Male Pigs, A Means to Avoid Surgical Castration Rikke Thomson, MSc, Aarhus University
15:05-15:15	Boar Tain Vaccination, A Possible Solution to Avoid Surgical Castration in Pigs Niels Wuyts, Director, Veterinary Operations, Zoetis
15:15-15:25	An NGO's Perspective on the Alternatives to Surgical Castration of Piglets Reineke Hameleers, Director, Eurogroup for Animals
15:25-15:35	Detection of Boar Taint, A Means to Avoid Surgical Castration Susanne Støier, Director, Meat technology, Danish Meat Research Institute
15:35-15:45	Stakeholder Perceptions of Alternatives to Surgical Castration of Male Piglets Klaus Grunert, Professor, Aarhus University
15:45-16:40	Discussions in plenum

SURGICAL CASTRATION WITH LOCAL ANAESTHESIA

Monika Löfstedt, Farm & Animal Health, Skara, Sweden

Surgical castration in piglets has been discussed from an animal welfare point of view for many years. In 2010 a Swedish study showed that local anaesthesia and analgesia reduced pain during and after castration, respectively. Furthermore, it was concluded that the farmers, after training, were able to inject local anaesthesia effectively⁽¹⁾.

As a result, farmers in Sweden are allowed to administer a local anaesthetic before castration, but only in piglets younger than seven days of age. In order to perform local anaesthesia farmers have to be trained and approved in conditional medicine usage according to Swedish regulations. Furthermore, they have to attend a course in "Safe and pain-free castration". The participants are instructed individually by a veterinarian on how to perform the local anaesthesia. After practice in order to learn the technique, they can be approved. In total, 1000 people working in 90 percent of our piglet-producing herds have passed the test.

An evaluation four years after the introduction of this system shows that it works well. The farmers experience the calmness of the farrowing unit and how much easier it is to castrate, even though the piglets have to be handled twice.

In Sweden today, all piglets are given analgesia (NSAID) at castration. About 10 percent of our herds are also using local anaesthesia. From January 2016 castration without anaesthesia is prohibited in Sweden and farmers who have been approved will have the option of administering local anaesthesia.

References

1. Hansson et al. *Acta Veterinaria Scandinavica* 2011, 53:34

PRODUCTION OF ENTIRE MALE PIGS – A MEANS TO AVOID SURGICAL CASTRATION

Rikke Thomsen, Department of Animal Science, Aarhus University, Denmark

Production of entire male pigs could be an alternative to surgical castration, to avoid the negative welfare aspects associated with the castration procedure. However, production of entire males can lead to other welfare issues, due to altered behavior of entire males resulting in increased aggression and mounting behaviour. To accommodate the altered behaviour, modifications in housing and management routines might be a solution. This could include more space available, occupational material and stable group composition. A large Danish study was conducted on five organic pig farms with the intention to investigate management approaches in relation to housing of entire male pigs under organic standards. All pigs had the opportunity to socialize prior to weaning and were mixed together at weaning with half the pigs undergoing a second mixing at 30 kg. Two different group sizes were applied. The results showed no increase in mean number of skin lesions for groups undergoing a second mixing. However, the different grouping strategies showed a significant effect on mounting frequency, but with no consistent pattern across herds. A significant increase in mean number of lesions was found in large groups compared to small, although the numeric difference was small. Mounting frequency significantly differed between group sizes, but with no consistent effect between the participating herds. No clear management recommendations in relation to grouping strategy when rearing entire males could be revealed. However, the organic production system seemed favourable for rearing entire males as regards welfare issues and elements of this system could be considered in a future production of entire male pigs.

BOAR TAIN VACCINATION, A POSSIBLE SOLUTION TO AVOID SURGICAL CASTRATION IN PIGS?

Niels Wuyts, Zoetis International Services

Consumers request that animals are treated correctly and humanely. They want to buy their pork with a guilt-free conscience. This is a logical and reasonable demand. Yet between 80-90% of pig producing markets continue unabated with surgical castration and other mutilations, with producers hoping that consumers will remain blissfully ignorant.

Surgical castration is ethically wrong and arguably also scientifically irresponsible. Irresponsible because the only benefit it provides is in the suppression of boartaint in male pigs. All other consequences of surgical castration – even with pain relief – are economically and ecologically detrimental for the producer, the processor and the consumer.

Conversely, if we can achieve production of boartaint-free animals without having to resort to surgical castration, we can turn all the negative effects into benefits.

Melbourne university in Australia invented a immunological way to prevent boartaint and boar aggressive behavior. This immunological solution is marketed worldwide by ZOETIS under the brand name IMPROVAC®. IMPROVAC® activates the pig's immune system to temporarily delay puberty in boars during the last weeks of fattening, hence effectively eliminating boar taint and boar behavior. It is important to stress that this vaccine is not a hormone. This technology also has a new application for use in female Iberico pigs, which are currently rather brutally spayed to prevent them from getting impregnated by wild boars when outdoors.

This presentation will go into more detail about the aspects described above

NGOS' PERSPECTIVE ON THE ALTERNATIVES TO SURGICAL CASTRATION OF PIGLETS

Reineke Hameleers, Director, Eurogroup for Animals

Male pigs are routinely castrated to prevent the risk of boar taint, an unpleasant flavour and smell which can be detected when the meat is cooked, and to minimise sexual aggressive behaviour. In the EU, this procedure can lawfully be performed on piglets without pain management within the first week of life. However, both the European Food Safety Authority (EFSA, 2004)¹ and the Federation of Veterinarians of Europe (FVE, 2009)² concluded that the procedure is painful and that it should only be carried out under anaesthesia and analgesia. Additionally, there is increasing societal pressure to phase out mutilations in livestock. To address these concerns, in 2010 the European Commission established the "European Declaration on alternatives to surgical castration of pigs". The Declaration is a voluntary commitment signed by 33 stakeholders of the pork chain, including farmers, veterinarians, meat industry, NGOs, governmental bodies, and researchers. The objective is to abandon surgical castration in the EU by 1 January 2018. On 26 February 2015, the results of the first four years of work and of the many research projects financed by the European Commission were presented at a workshop attended by 200 participants. Speakers shared their successful experiences at farm and at retail level with raising and marketing boars and vaccinated pigs, showing that solutions are at hand. However, still a lot needs to be done to overcome the many obstacles, real or perceived, that lie ahead of us if we want to reach our goal to phase out this unnecessary mutilation.

¹ Opinion of the Scientific Panel on Animal Health and Welfare on a request from the Commission related to welfare aspects of the castration of piglets, The EFSA Journal (2004) 91, 1-18.

² FVE Position paper on pig castration (2009) http://www.fve.org/news/position_papers/animal_welfare/fve_09_040_castration_pigs_2009.pdf.

DETECTION OF BOAR TAIN, A MEANS TO AVOID SURGICAL CASTRATION?

Susanne Støier, Director, Meat Technology/DMRI, Danish Technological Institute

A major concern related to a stop of surgical castration is the risk of boar taint, which causes an unpleasant flavour when the meat is heated and therefore poses a potential risk of negative consumer reactions. It is generally accepted that boar taint is caused by the presence of skatole and androstenone. Due to the high risk of negative consumer reactions, it is crucial that the tainted meat is sorted and used for other purposes than fresh meat consumption. In Denmark, the skatole method is in use at one slaughterhouse, although, from a technical point of view, this method is not up to date. Furthermore, the capacity is limited, and androstenone is not analysed. Given the pork industry is going to produce entire males in large scale, an instrumental on-line method detecting skatole as well as androstenone is needed. Researchers are currently conducting a search for a new advanced on-line method. In the meantime, human nose assessment is emerging as a sorting method of today. The two most commonly used methods are the “hot iron method” and, to a lesser extent, the “hot water method”. The hot water method is used in Denmark, although, due to practical limitations, the method is only used in small-scale production facilities. The hot iron method has been implemented in several slaughterhouses in, for example, the Netherlands and Germany as an on-line method. But even so, there are significant sensory-based concerns related to this approach that need to be addressed, even though there is currently no solution to these concerns.

STAKEHOLDER PERCEPTIONS OF ALTERNATIVES TO SURGICAL CASTRATION OF MALE PIGLETS

Klaus G. Grunert, MAPP Centre for Research on Customer Relations in the Food Sector, Aarhus University, Denmark

Stakeholder views on alternatives to surgical castration were investigated based on expert interviews in Australia, Belgium, Holland, Italy, Japan, China, Poland, Russia, Spain, Germany, UK and USA. Three major themes were addressed: animal welfare, boar taint, and technophobia. As for which of the alternatives to surgical castration is best from an animal welfare point of view, there was good agreement that the production of entire males would be best from an animal welfare point of view. There were diverging opinions on the feasibility of castration with anesthesia, with some methods getting better evaluations than others. Immunocastration was generally regarded as acceptable from an animal welfare point of view, except in Holland. There were widely different views on the seriousness of the boar taint issue. Also views on the right way to prevent boar taint are related to how serious one believes the problem is. In China and Japan all alternative methods are viewed with considerable skepticism. Immunocastration was otherwise regarded as a reliable alternative that can effectively prevent boar taint. There were considerable differences in the perceived reliability of sorting procedures. The main reason for not using immunocastration was fear of consumer reactions – that consumers would view this as an unacceptable type of hormone treatment.

WORKSHOP 3

TAIL DOCKING OF PIGLETS

Purpose of the workshop

This workshop will deal with tailbiting and tail docking. The workshop will focus on tail docking strategies and on how to prevent outbreaks of tail biting (and thereby avoid the use of tail docking) – and whether this is possible.

Organizers:

- Karen Thodberg, University of Aarhus
- Mette Herskin, University of Aarhus
- Heidi Mai-Lis Andersen, University of Aarhus
- Dorte Schrøder-Petersen, Danish Veterinary and Food Administration

Workshop moderator

- Karen Thodberg, University of Aarhus

Workshop programme

14:40-14:45	Introduction to the workshop Karen Thodberg, University of Aarhus
14:45-15:00	Outcome of Audits of EU Member States on Animal Welfare on Pig Farms Desmond Maguire, Food and Veterinary Office (FVO), European Commission
15:00-15:15	Routine Tail Docking is Illegal Birgitte Damm, Senior policy advisor, The Danish Animal Welfare Society
15:15-15:30	Intact Tails - A Challenge! Torben Jensen, Chief Manager, SEGES, Danish Pig Research Centre
15:30-15:45	Short break
15:45-16:40	"Café-workshop"

OUTCOME OF AUDITS OF EU MEMBER STATES ON ANIMAL WELFARE CONTROLS ON PIG FARMS

D. Maguire, European Commission Food and Veterinary Office, Animal Health and Welfare, Grange, Dunsany, Co. Meath, IRELAND, Desmond.Maguire@ec.europa.eu

The Food and Veterinary Office (FVO) of the European Commission's Directorate General for Health and Food Safety carried out a series of audits in 2005 on Member States' (MS) implementation of Directive 2008/120/EC dealing specifically with the welfare of pigs on farm. This covered seven countries.

The findings in relation to tail docking on pig farms were poor. Training for stockpersons was not available in half the MS. There was little advice available to farmers on avoidance of tail-docking, and the provision of manipulable materials by them was limited.

Competent Authorities (CA) were not effectively enforcing the prohibition of routine tail docking. FVO issued recommendations to MS to ensure that suitable materials for manipulation were made available on farm and training courses made available for stockpersons.

Further audits took place between 2006 and 2008. Most of the remaining MS were visited. The findings again indicated widespread non-compliance and ineffective enforcement of the prohibition of routine tail docking and the provision of manipulable material, with the exception of Sweden and Finland, which have national bans on tail docking. FVO made further recommendations to CAs on materials for manipulation and measures to avoid tail-docking.

General audits to MS between 2008 and 2012 focussed on CAs' official controls rather than specific sectors. Nonetheless, where noted, there was still ineffective enforcement of requirements relating to tail docking.

The Commission has been following up outstanding recommendations and will assist MS through the development of various tools to address this longstanding issue.

ROUTINE TAIL DOCKING IS ILLEGAL

Birgitte Damm, DVM, Ph.D., Senior policy advisor
The Danish Animal Welfare Society

Routine tail docking has been banned in the EU for more than 20 years. However, to enable highly stressful production methods stress-induced tail biting continues to be managed by routine tail docking in many EU member states. Tail biting is a multifactorial problem but manipulable materials that the pigs can root are particularly important in reducing the risk of tail biting. Pigs are usually not given these materials.

In 2007, EFSA estimated that 99 percent of Danish pigs were tail docked and today the situation remains the same. In 2012 the Danish Animal Welfare Society (DAWS) filed an official complaint to the European Commission. The Commission agreed that Denmark is noncompliant as demonstrated also by FVO inspections. However, the Commission refused to initiate infringement procedures with reference to planned guidelines for the legal obligations contained in the Pigs Directive, including the ban on tail docking and the demands for enrichment. To date, more than ten years after the directive entered into force, the guidelines have not been issued.

In cooperation with MEPs DAWS has also brought the complaint to the Committee for Petitions (PETI) in the European Parliament. At each of three meetings PETI emphasized that the obvious violation of the ban should be taken more seriously by the Commission and infringement procedures should be initiated.

Over the years DAWS and PETI have expanded the complaint to include the fact that noncompliant member states can produce pigs using fewer resources than compliant member states leading to market distortion. As a consequence the Parliament's DG for internal policies recently

performed an in-depth analysis of the problem. It was concluded that of the 36 member states 17 are noncompliant and strong support was given to the shared position of DAWS and PETI that the evident systematic violation of EU legislation cannot be allowed to continue.

INTACT TAILS – A CHALLENGE!

Torben Jensen, Chief Manager, M. Sc., SEGES, Danish Pig Research Centre, Axeltorv 3, DK-1609 Copenhagen V

Handling pigs with intact tails is a challenge. The effect of cessation of tail docking was investigated in two conventional herds. The results showed an increase in the number of tail lesions but there was a large difference in tail lesion incidences between herds. In one of the herds, 51 % of the pigs with intact tails had a tail lesion at least once between 7-110 kg (Lahrmann et al, 2015). Organic pig production is not without tail biting problems. Tail lesions are more frequent among organic/free-range pigs than among conventional pigs (OR=3.2) (Alban et al, 2015).

In a review based on research where tail injuries were quantified, there was good evidence that manipulable substrates and feeder space affect damaging tail biting. Only epidemiological evidence was available for effects of temperature and season, and the effect of stocking density was unclear. Studies suggest that group size has little effect, and the effects of nutrition, disease and breed require further investigation (D'Eath et al, 2014).

A decision-tree model based on data from Danish and Finnish pig production suggests that a standard production system with tail docked pigs provides the highest economic gross margin with the least tail biting. An enhanced system with undocked pigs is the least economic and results in a lower prevalence of tail biting than a standard production system with undocked pigs but higher than the standard production system with tail docked pigs. For a pig, being bitten is worse for animal welfare (repeated pain, risk of infections) than being docked, but comparing animal welfare consequences at farm level is difficult because the number of affected pigs must be considered. By tail docking, producers are acting in their own best interests (D'Eath et al, 2015).

WORKSHOP 4

PROMOTING SUSTAINABILITY AND PIG WELFARE: IS IT POSSIBLE?

Purpose of the workshop

Sustainability and animal welfare are two parameters, which is expected in future farm animal production. Depending on definitions, however, there might be conflict of interests between actions promoting these qualities. The workshop will investigate whether actions for improving animal welfare in pig production will reduce possibilities for promoting sustainability

Organizers:

- Jan Tind Sørensen, Professor, Aarhus University
- Mette Kirkeskov Sie, Danish Veterinary and Food Administration

Workshop moderator

- Jan Tind Sørensen, Professor, Aarhus University

Workshop programme

14:40-14:50	Introduction to the workshop Jan Tind Sørensen, Professor, Aarhus University
14:50-15:15	Sustainability and Animal Welfare - Can They Go Hand in Hand? Karsten Klint Jensen, Associate professor, Copenhagen University
15:15-15:40	Improved Sustainability in Organic Pig Production Anne Grete Kongsted, Senior scientist, Department of Agroecology, Aarhus University
15:40-16:40	Discussions in plenum

SUSTAINABILITY AND ANIMAL WELFARE – CAN THEY GO HAND I HAND?

Karsten Klint Jensen, Dept. of Food and Resource Economics, University of Copenhagen, Rolighedsvej 25, DK-1958 Frederiksberg C.; kkj@ifro.ku.dk

The aim of this paper is to provide some of the conceptual clarification, which is necessary for a meaningful answer to the question whether sustainability and animal welfare can go hand in hand. The widely used concept of 'sustainability' is seldom precisely defined, but without clear definition it becomes an empty concept. I see two lines of interpretation in the literature. One I shall call bottom-up. It takes a certain activity as its starting point and asks what it requires to sustain this activity over time. Originally, this was a question of ensuring that the necessary resources could be renewed. Later, also social factors such as acceptance from key stakeholders have been included. The other I shall call top-down. It takes some interpretation of the Brundtland Commission's suggestion that the present generation's need-satisfaction should not compromise the need-satisfaction of future generations as its starting point. The underlying goal is here to keep human welfare on a global level non-diminishing over time. It then infers prescriptions from this requirement. The latter approach is less determinate and involves considerable uncertainty. However, it raises a question which does not become visible in the first approach: Is the activity in question at all worth pursuing?

Similarly, animal welfare is a concept with conflicting definitions. The major contenders are mental state accounts, according to which the welfare of an animal is a matter of the experienced quality of its mental states, and what philosophers call perfectionist accounts, according to which the welfare of an animal consists in its inherent nature being unfolded and fulfilled. On the first interpretation, the welfare of an animal, at least in theory, can be promoted in very artificial environments, whereas the second interpretation involves more rigid requirements to the naturalness of the environments and the life of the animal.

The paper will conclude in lining up compatibility and potential conflicts between sustainability and animal welfare on this background, looking at the dimensions of food security, effects on the environment, animal welfare and uncertainty about future technologies.

IMPROVED SUSTAINABILITY IN ORGANIC PIG PRODUCTION

AG Kongsted, JE Hermansen & M. Jakobsen, Dept. Agroecology, Aarhus University, Blichers allé 20, 8830 Tjele, Denmark; anneg.kongsted@agro.au.dk

The local and global sale of organic pork produced in Denmark has increased markedly in recent years. Organic pig production is associated with several positive aspects from a societal point of view e.g. very low use of antibiotics and animals being able to express more of their natural behavior compared to conventional production. However, there are some challenges regarding sustainability that needs to be addressed. In Denmark, organic pig production is based on outdoor sow production all year round while the majority of growing pigs are kept in stables with access to a concrete covered outdoor run. The outdoor production of sows imposes a significant risk of nutrient leaching, especially in paddocks with lactating sows. The outdoor run for growing pigs is associated with high ammonium emissions and causes problems with poor hygiene. Finally, the current practice puts a higher pressure on land resources compared to conventional production due to lower crop yields combined with a poorer feed conversion. There is a need to develop production strategies to improve the sustainability of organic pig production. We investigate whether i) integrated production of energy crops (or other woody vegetation) and free-range pigs, ii) increased nutritional contribution of roughage and direct foraging, and iii) environmental enrichment of the outdoor run for growing pigs are promising developments for organic pig production. Preliminary results from the national project, pEcosystem, and the EU project, Agforward, will be presented.

WORKSHOP 5

MARKET DRIVEN ANIMAL WELFARE. THE ROLE FOR RETAILERS AND CONSUMERS

Purpose of the workshop

The purpose of the workshop is to discuss how far and in what way the market will be able to drive animal welfare. What can we expect from retailers and consumers?

Organizers:

- Peter Sandøe, Professor, University of Copenhagen
- Tove Christensen, Associate Professor, University of Copenhagen
- Tina Birk Jensen, Danish Centre for Animal Welfare, Danish Veterinary and Food Administration

Workshop moderator

- Peter Sandøe, Professor, University of Copenhagen

Workshop programme

14:40-14:45	Introduction to the workshop Peter Sandøe, Professor, University of Copenhagen
14:45-15:00	Animal Welfare Labelled Pork in Denmark - Room for Improvement? Tove Christensen, Associate Professor, University of Copenhagen
15:00-15:15	Who Will End the Waiting Game? Lars Esbjerg, Associate Professor, Department of Business Administration, Aarhus University
15:15-15:30	What Can Consumers and Retailers Expect from the Market? Esben Meier, Category Group Manager, COOP, Denmark
15:30-15:45	EconWelfare: Upgrading Animal Welfare Standards Across Europe Hans Spoolder, Professor, Wageningen University
15:45-16:00	Market Driven Animal Welfare - Does the EU Have a Role to Play? Denis Simonin, European Commission
16:00-16:40	Discussions in plenum

ANIMAL WELFARE LABELLED PORK IN DENMARK – ROOM FOR IMPROVEMENT?

Tove Christensen, Sigrid Denver and Peter Sandøe
Institute of Food and Resource Economics, University of Copenhagen

Denmark has among the highest levels of organic consumption in the world when looking at the overall market shares. Nevertheless, the market shares for organic meat and other types of welfare friendly meat are low and animal welfare friendly production systems remain a niche.

The main Danish animal welfare organisation, Dyrenes Beskyttelse, owns a label that approves premium levels of animal welfare that comply either with organic or similar standards for pork, beef and poultry meat productions. Also, meats from production systems that guarantee medium levels of animal welfare with improved indoor conditions are available in the Danish supermarkets. These products are not approved by Dyrenes Beskyttelse fresh pork sold in Denmark.

Other countries seem to be successful in using a different strategy where national animal welfare associations approve medium as well as premium levels of animal welfare (Christensen et al. 2014; Heerwagen et al. 2015). These include Five Freedom certifications in the UK and Beter Leven in the Netherlands that account for fresh pork market shares over 30 %.

We want to argue that there is a potential for increasing the market shares in Denmark for pork associated with medium levels of animal welfare without compromising the markets shares for premium animal welfare pork. In the talk we will present evidence based on various consumer studies which seem to support our conclusion.

References

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Heerwagen, L.R., Mørkbak, M.R., Denver, S., Sandøe, P. & Christensen, T. (2015). The Role of Quality Labels in Market-Driven Animal Welfare. *Journal of Agriculture and Environmental Ethics* (2015) 28:67–84.

WHO WILL END THE WAITING GAME?

Lars Esbjerg, MAPP Centre for Research on Customer Relations in the Food Sector, Aarhus University

The purpose of this presentation is to discuss if we can expect actors in the pork chain from farm to retailer to drive improvements in animal welfare. Based on 40 interviews conducted with actors within the Danish pork sector and on five important export markets (Australia, China/Hong Kong, Great Britain, Sweden and the United States), it will be argued that many actors – not least in Denmark – are playing a waiting game, i.e., they are waiting on other actors to take the initiative and drive improvements of animal welfare standards forward.

Improvements in animal welfare conditions are contingent on many actors along the entire value chain making the necessary investments and changing their market practices. Our informants were all positive about improving animal welfare, yet often shied away from taking the initiative and to make these investments as they were uncertain about consumer demand for animal welfare being sufficiently large. Our study suggests that external pressure is often required for firms to change their practices in relation to animal welfare (e.g., to meet regulatory requirements, satisfy consumer demand or to protect corporate reputation out of fear of being named and shamed). However, there is also an opportunity for firms to be proactive and use animal welfare as a means to differentiate themselves from their competitors. Indeed, many of the actors covered by our study worked actively to improve animal welfare conditions and foster supply and demand of welfare products.

WHAT CAN CONSUMERS AND RETAILERS EXPECT FROM THE MARKET?

Esben Meier, Category Group Manager, COOP, Denmark

Coops ambition is to increase the number of animals breed with better Animal Welfare by 1 million in 2020, including pigs living a better life with more natural behavior.

We regularly collect valuable information from consumers, and these surveys underpin Animal Welfare as an important issue. Consumers want good, healthy, innovative, and fairly prized products that inspire to eat better meals, aligned with the initiatives launched in our Food Manifesto.

When Coop introduced every-day-low-price in organic fresh meat the demand grew dramatically from day one, also revealing the prize sensitivity of the products. Immediately the market followed and now organic and/or pork with better animal welfare are close to 100% distribution in the market. Each retailer will drive the demand for products with better animal welfare by listening to the consumer and working closer with farmers and industry.

The Danish industry is export focused and of all pigs born in Denmark it is estimated that less than 2% is with better animal welfare than standard for the domestic market. Even by doubling this figure it is clear that the big step is taken by focusing on the general animal welfare on farms in Denmark and across Europe. Higher standards in general will create a market where supply, demand, and prizes are balanced.

Thus a positive trend and demand in the Danish FMCG market for products such as organic, free range, specialty pork which in combination with better general standard will give happier pigs and consumers.

ECONWELFARE: PROJECT TO PROMOTE INSIGHT ON THE IMPACT FOR THE ANIMAL, THE PRODUCTION CHAIN AND SOCIETY OF UPGRADING ANIMAL WELFARE STANDARDS.

Hans Spoolder, Wageningen UR Livestock Research, PO box 338, 6700 AH Wageningen, The Netherlands. Hans.Spoolder@wur.nl.

The main objective of the EconWelfare project was to reveal what policy instruments might be effective in the route towards higher animal welfare in Europe, representing the concerns of civil society whilst guaranteeing the competitiveness of the livestock industry. The project contained four main parts, aiming a) to identify and analyse current animal welfare standards and initiatives; b) to ask stakeholders for strengths and weaknesses of these standards and initiatives; c) to develop policy instruments and indicators towards an Action Plan on Animal Welfare; and d) to look at the benefits & costs of upgraded animal welfare standards and initiatives.

The main project conclusion is that although the overall goal of animal welfare policy should be the same everywhere in the EU, it is unlikely to be achieved in similar ways, with equal speed and at the same time. This is due to differences in level of legislation, price competition, national income, awareness of citizens and consumers, position of retailers, development of NGOs, farmer skills, awareness et cetera.

Other conclusions are 1) that EU wide legislation is important to set the lower boundaries for farm animal welfare, and that these need to be enforced; 2) for efficient farms operating with best possible practices, there is an inevitable increase in cost when increasing animal welfare standards; 3) the most successful existing welfare enhancing initiatives combine multiple goals with the use of multiple policy instruments; 4) that more transparency towards consumers and business-to-business is needed on animal welfare issues, and that an EU harmonised welfare labelling system for animal products could strongly support this transparency.

MARKET DRIVEN ANIMAL WELFARE - DOES THE EU HAVE A ROLE TO PLAY?

Denis Simonin, European Commission, Directorate-General for Health and Consumers Animal Welfare

Surveys show that most consumers are interested in animal welfare. However, on unprompted questions, few of them mention it. This is not necessarily a paradox. Consumer's behaviour is complex. People have various unexpressed expectations regarding product quality.

The EU successfully introduced a compulsory system for labelling table eggs which informs consumers on production methods. The EU legislation has also defined production methods on a voluntary basis for organic farming and poultry meat.

There are voluntary schemes where animal welfare is explicitly communicated to consumers. This "active" approach is popular in some countries (e.g. UK, Netherlands, and Germany). Other schemes may have animal welfare as part of their quality attributes but not always communicated ("defensive" approach).

Consumers' today are overwhelmed with information. They spend little time buying food and have difficulties grasping the complexity of production systems. This is why many consumers tend to trust brands rather than looking for specific information (like animal welfare).

Against this background, retailers have an interest in meeting consumers' expectations, even when not clearly expressed, which change with local conditions and over time. They have the potential for directing changes towards better welfare for the animals through their supply chain.

However, out of many claims, some may be misleading and may put producers who apply better standards in difficult position. There should be a continuing debate on how public authorities (including the EU) should improve transparency so that the market driven approach works in the interest of consumers and producers as well as in favour of the animals.

WORKSHOP 6

ANIMAL WELFARE EDUCATION AND TRAINING – HOW, FOR WHOM AND TO WHAT EFFECT?

Purpose of the workshop

The purpose of the workshop is to explore and discuss how education and training may drive animal welfare improvements. How should animal welfare training and education be conducted, who are the target groups and what effect may we expect?

Organizers:

- Helle Stege, Associate Professor, University of Copenhagen
- Inger Anneberg, Postdoc, Aarhus University
- Lene Munksgaard, Professor, Aarhus University
- Lise Tønner, Special Advisor, Danish Centre for Animal Welfare, Danish Veterinary and Food Administration

Workshop moderator

- Lene Munksgaard, Professor, Aarhus University

Workshop programme

14:40-14:45	Introduction to the Workshop Lene Munksgaard, Professor, Aarhus University
14:45-15:05	Pig Welfare Education - an RVS Perspective Mandy Nevel, Senior Lecturer, Royal Veterinary College, University of London
15:05-15:15	Communication about Animal Welfare in Danish Agricultural Education Inger Anneberg, Postdoc, Aarhus University
15:15-15:20	Teaching Materials for Animal Welfare in Danish Pig Education Rikke Svarrer, The Danish Pig Research Institute
15:20-15:40	Animal Welfare Education and Training - In the American Setting Monique Pairis-Garcia, Assistant Professor, Ohio State University
15:40-15:55	Teaching Animal Welfare in Schools - How and Why to Engage the Next Generation Monika Hametter, Tierschutz macht Schule
16:00-16:40	Discussions in plenum

PIG WELFARE EDUCATION – AN RVC PERSPECTIVE

Amanda Nevel, BSc BVetMed, PhD, PGCertVetEd, MRCVS
Royal Veterinary College, London

At RVC, we believe that learning animal behaviour and ethics as well as welfare are key to producing scientists equipped to work in the animal welfare arena. The curriculum of our courses, along with teaching and assessment methods used at RVC will be outlined and discussed. The largest course at the RVC is the BVetMed course (for veterinarians), however we have a wide portfolio of other science degrees, including undergraduate and post-graduate welfare courses. A new undergraduate degree BSc Biological Sciences (Animal Behaviour, Welfare and Ethics) is due to start in 2016.

These courses are designed to best educate those involved in welfare and empower them to achieve positive changes. Whilst these courses are mainly generic, we will consider how they relate to pigs.

We will consider;

- Who is and who should be driving the pig welfare agenda and
- How can we best inform and educate these individuals?
- How do we best measure the impact of our education?
- How do we know we have successfully educated our learners?

You will be encouraged to reflect on how you learnt about animal welfare and how that has impacted your role today. What worked well and what had little impact. We will identify potential gaps and opportunities where training is required and how this could be best implemented. How can we use digital technology to enhance our training/education programmes?

COMMUNICATION ABOUT ANIMAL WELFARE IN DANISH AGRICULTURAL EDUCATION

Inger Anneberg*, Anthropologist, Post Doc & Jesper Lassen**, Sociologist, Professor

*Aarhus University, Department of Animal Science

**University of Copenhagen, Department of Food and Resource Economics.

As a consequence of the widespread public concern about animal welfare in Danish agriculture, agricultural colleges have an important task when it comes to prepare and train coming farmers to handle societal expectations. Equipping the to-be farmers with technical and practical knowledge is thus not enough – today the moral and ethical issues related to the field of animal welfare is an increasingly important subject.

So far no research has addressed the relation between agricultural education and students' perception of animal welfare in a Danish context. The aim of this project therefore is to study how students at Danish agricultural colleges understand animal welfare – and to what extent animal welfare is prioritized at the colleges. The project started in December 2014 and runs for one year.

Methodologically, the study uses a combination of ethnographic field-observations and qualitative interviews on four agricultural colleges. Interviews were carried out in order to explore students' view of animals and their priorities regarding animal welfare. Individual interviews were carried out with new students while focus group interviews were carried out with older students, about to finish their education as farmers specialising in livestock. Furthermore, teachers in livestock (pigs/cattle) were interviewed about their inclusion of animal welfare in the teaching.

The coming analysis will focus on issues like how teaching in animal welfare is influenced by the complexity of the agricultural education and its regular alternation between shorter periods at school

and longer periods of apprenticeship. Other themes in the analysis will address differences in the view of animal welfare between younger and older students, as well as the how perceptions animal welfare and animal welfare training at the agricultural colleges match the views and expectations of the surrounding society.

TEACHING MATERIALS FOR ANIMAL WELFARE IN DANISH PIG EDUCATION

Rikke Ingeman Svarrer*, Master of Science in Husbandry, Project Manager

*SEGES, Danish Pig Research Centre

Teaching animal welfare at agricultural colleges has been done in various ways through many years. It has rarely been a detached subject, but instead a part of subjects such as feeding, disease control and housing systems. Consequently the focus on animal welfare in teaching pig production has been less visible. Agricultural colleges play an important role in training future pig farmers to handle challenges in animal welfare.

Therefore the Danish Pig Research Centre has entered into a partnership with the teachers in pig production at all agricultural colleges in order to develop teaching materials to be used at all schools – teaching materials that addresses pig welfare in Danish production systems.

The teaching materials are to be used at all levels of the farmer education and are based on a Power-Point presentation with many photographs and video sequences. Furthermore different assignments for the students are being developed for the teachers to use if they desire to. All teaching materials for teaching animal welfare in pig production at agricultural colleges are expected ready in September 2015.

ANIMAL WELFARE EDUCATION AND TRAINING – IN THE AMERICAN SETTING?

Monique D. Pairis-Garcia¹, Anna K. Johnson², Jessica D. Colpoys²

¹The Ohio State University, Columbus, OH, USA

²Iowa State University, Ames, IA, USA

An understanding of animal welfare is essential to animal agriculture professionals, including students, producers, and youth. Educational opportunities exist in formal and informal courses. These can be delivered through traditional methods via in-person or online. In the US, an increasing number of students with non-agricultural backgrounds are enrolling in formal animal and veterinary science programs and these “non-traditional” students are presenting new challenges for instructors. Therefore, it is important to adjust pedagogical styles to better fit student needs. Such pedagogical styles include; interaction i.e. on-farm visits, wet laboratories, and case studies. In addition, development of animal welfare educational resources is imperative for producers and youth working directly with livestock and within the agricultural industries. In the US, several assessment programs have been developed including the Pork Quality Assurance Plus® program (PQA plus), Beef Quality Assurance Program® (BQA) and the National Dairy Farmers Assuring Responsible Management® (FARM). These tools provide educational material and hands-on consulting for farmers to improve in areas such as animal health, animal handling and on-farm record keeping. Youth programs developed by Land Grant Universities such as The Ohio State University and Iowa State University provide a beneficial platform to teach animal welfare to younger generations, inspiring students to learn that in turn helps ensure future sustainability of animal welfare programs within Universities.

TEACHING ANIMAL WELFARE IN SCHOOLS – HOW AND WHY TO ENGAGE THE NEXT GENERATION

DI Monika Hametter, Deputy Director, Tierschutz macht Schule

Knowledge about the ethology, needs and living conditions of animals provides the basis for animal welfare. It is therefore crucial to integrate these issues into the education system. As future owners and consumers our children should engage with and care for animals from an early age. Caring for animals also fosters important social competences such as taking responsibility or expressing empathy.

The Austrian Association "Tierschutz macht Schule" (Association for Animal Welfare Education) has reached 450,000 children and young people with engaging and easy-to-use teaching magazines and practical animal welfare workshops. In this way animal welfare becomes an integral part of classroom teaching. At the same time teachers who are important multipliers in the education system can attend a special training to deepen their knowledge about the well-being of animals.

To enable a fruitful integration of animal welfare into the education system, it is crucial to establish a transdisciplinary network with stakeholders such as official bodies, policy-makers, scientific experts and the media, who support the cause and create trust. Over the years other criteria for success such as in-depth knowledge based on scientific facts, solution-oriented approaches or child-friendly language have evolved. Based on these criteria, valuable projects such as the recent work of three school classes on the welfare and societal role of pigs can be realized. Responsible teaching of animal welfare provides pupils with the opportunity to develop their own opinion and find ways to further engage with the subject.

WORKSHOP 7

TRANSPORT OF PIGS AND ANIMAL WELFARE

Purpose of the workshop

The purpose of the workshop is to discuss which issues in relation to animal transport that would have highest priority in relation to improvements of the animal transport legislation?

Organizers:

- Mette S. Herskin, Senior Researcher, Aarhus University (mettes.herskin@anis.au.dk)
- Jens Frederik Agger, Associate Professor, Copenhagen University (jfa@sund.ku.dk)
- Henrik Elvang Jensen; Professor, Copenhagen University (elvang@sund.ku.dk)
- Stig Møllergaard, Chief Advisor, Danish Veterinary and Food Administration (stim@fvst.dk)

Workshop moderator

- Jens Frederik Agger, Associate Professor, Copenhagen University (jfa@sund.ku.dk)

Workshop programme

14:40-14:45	Introduction to the workshop Jens Frederik Agger, Copenhagen University
14:45-14:55	Putting Transport of Pigs into Perspective Per Olsen, Danish Agriculture and Food Council
14:55-15:05	Are Sows Sent for Slaughter Fit for Transport? Mette S. Herskin, Senior researcher, Aarhus University
15:05-15:15	Transport Injuries Found during Transport Controls Stig Jessen, Special Veterinary Advisor, Danish Veterinary and Food Administration
15:15-15:35	Assessing Pig Welfare during Long Road Journeys Antonio Velarde, IRTA Animal Welfare Subprogram Spain
15:35-15:45	Simple and Operational Measures for Assessment of Welfare of Finishing Pigs on the Day of Slaughter Pia Brandt, Danish Technological Institute
15:45-16:40	Discussions in plenum

ARE SOWS SENT FOR SLAUGHTER FIT FOR TRANSPORT?

Karen Thodberg, Katrine K. Fogsgaard, Mette S. Herskin

University of Aarhus, Department of Animal Science, AU-Foulum, Denmark

Each year more than 400.000 Danish sows are sent for slaughter and transported by road to abattoirs. To date, only very limited knowledge about the fitness for transport of these animals are available, as most research on pig welfare on the day of slaughter have focused on finishing pigs. However, for each individual sow, the fitness for transport must be assessed pre-transport in order to avoid transportation of unfit sows, leading to unnecessary suffering and potential violation of the animal protection legislation.

This talk presents an on-going project aimed to gain knowledge about fitness for transport of sows sent for slaughter in Denmark. Via recordings of behaviour and clinical condition of the animals on-farm and upon arrival at an abattoir, conditions during transport (duration 0-8h), as well as post mortem pathological findings, this project seeks to provide knowledge about relations between the baseline condition of the sows, risk factors and the condition of the sows upon arrival at the abattoir. This information will form basis of the development of a scoring system, which will facilitate the pre-transport assessment of fitness for transport in sows.

The project involves an on-going observational study of approximately 600 Danish sows destined for slaughter. We record data during several of the phases characterising the day of slaughter: on-farm (baseline), during a stay in a pick-up facility before transport, during loading onto the vehicle, during transport, during unloading and at the entrance to the abattoir, during lairage and after sticking.

This project is part of a larger Danish initiative focussing on farm animal fitness for transport. The two other sub-projects involve dairy cows and broilers.

INSPECTION OF TRANSPORTS WITH LIVE PIGS

Stig Jessen, Special Veterinary Adviser, Danish Veterinary Task Force, Rosenholmsvej 15, 7400 Herning, correspondence: stij@fvst.dk

Every year about 20 million pigs are transported for slaughter in Denmark and several millions of smaller pigs (BW 25-35 kg) are transported between farms within the European Union for fattening. The Danish Veterinary Task Force has since 2006 collaborated with the Danish Police in conducting roadside inspections of live-animal transports. About 1000 vehicles are inspected every year, and any type of vehicle can be sampled. The inspections are usually conducted on highways and freeways, near slaughterhouses and assembly centers. The objective of the inspections is to verify that all animals are suited for transportation and that vehicles used for live-animal transportation comply with current legislation.

In 2014 the Police and the Veterinary Task Force found problems on 48 out of 467 transports with swine (10%).

When conducting the inspection the Veterinary Task Force typically focuses on the number of animals per square meter, signs of illness or injury and the state of the transportation vehicle. If a pig is found on a transport with injuries or symptoms of illness, the pig is evaluated on site. When evaluating injured or ill pigs, on a transport, the main focus is to estimate the suffering or the potential suffering of the animal, the level of pain that is caused by the injury, and what can be done to minimize further suffering.

General problems found by the Veterinary Task Force on transports of live pigs were overloading and pigs not suited for transportation. On journeys above 8 hours one of the main problems was that the pigs did not have access to water for the duration of the journey. The primary problems found in transportation of slaughter pigs were injuries, tail bites, infected auricular haematomas, hernias,

and lameness caused by infections in the joints of the limb and foot. The smaller pigs (BW 25-35 kg) were usually fit for transport, though, sometimes piglets with ear infections, severe ear bites and lameness were found.

If the Veterinary Task Force identifies problems with or on a vehicle, a solution is pursued. The optimal solution varies, from letting the transport proceed to the destination point to sending the transport back to the point of departure. In cases where an animal is suffering the Veterinary Task Force will usually attempt to unload the animal as close to the point of inspection as possible to minimize unnecessary suffering.

ASSESSING PIG WELFARE DURING LONG ROAD JOURNEYS

Antonio Velarde¹, Cecilia Pedernera¹, Patrick Chevillon², Michael Marahrens³, Karin vonDeylen³, Hans Spoolder⁴

¹IRTA Animal Welfare Subprogram, E-17121, Monells, Spain

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³FLI Institute for Animal Welfare and Animal Husbandry, Doernbergstr. 25-27, D-29223 Celle, Germany

⁴Wageningen UR Livestock Research, P.O. Box 65 8200 AB Lelystad, The Netherlands

Each year in Europe around 28 millions pigs are transported over journeys that last more than 8 hours. Pigs are mainly transported from North West Europe to Bulgaria, Germany, Italy, Romania and Spain. Current regulation for protection of animals during transport (Regulation EC 1/2005) is based on requirements related to resource and management recommendations. The project 'Development of EU wide animal transport certification system and renovation of control posts in the European Union', funded by DG SANCO, developed a protocol for the welfare assessment of pig transport to provide a foundation for a quality certification system (www.controlpost.eu). The protocol is based on the 12 criteria of the Welfare Quality® grouped into four principles (good feeding, good housing, good health and appropriate behaviour). One of the innovations of the assessment system is that it focuses on animal based measures (e.g. directly related to animal body condition, health aspects, injuries, behaviour, etc.) together with handling, resource, truck and transport measures. The protocol is carried out upon arrival, during unloading and at the resting pens. Animal based measures at arrival and during unloading include slipping, falling, reluctance to move, turning back, lameness and dead pigs. At the resting pens after unloading, body condition, sickness, cleanliness and wounds on the body are assessed. Resource and transport based measures include, among others, space allowance, travelling times, rest periods, provision water and feed, loading density and ramp slope. The protocols may be used, after previous training, by transporters, animal welfare officers and control post owners as a self-assessment management tool to identify welfare problems or risks, and to monitor improvements.

SIMPLE AND OPERATIONAL MEASURES FOR ASSESSMENT OF WELFARE OF FINISHING PIGS ON THE DAY OF SLAUGHTER

Pia Brandt, Danish Meat Research Institute, Gregersensvej 9, DK-2630 Taastrup, pbt@teknologisk.dk

Increasing interest and concerns from the market and the authorities regarding animal welfare creates a need not only to improve welfare of animals but also to document the level of animal welfare. For documentation purposes simple measures that are automatable are needed in order to perform systematic monitoring. The Welfare Quality® (WQ®) developed a comprehensive welfare assessment protocol for pigs on farm or at the abattoir, however, the protocol is not operational as such for systematic monitoring under commercial conditions.

Blood lactate and creatine kinase activity have been studied previously and are related to the measures of welfare in question, e.g. handling and backing up. Furthermore, blood is available in abundance at exsanguination and can be collected non-invasively, which makes blood measures good candidates for on-line monitoring of welfare. Therefore, we aimed to investigate the relationship between an overall assessment of welfare based on the WQ® protocol and selected post mortem physiological measures (glucose, lactate, creatine kinase activity, albumin and total protein). Thus, a welfare assessment based on behavioral and clinical measures was carried out and aggregated into an animal welfare index (AWI) using expert opinion.

The results indicated relationships between single ante-mortem welfare measures and post mortem physiological measures, as e.g. falling in the race to stunning and glucose. Relationships between the AWIs and the physiological post mortem measures were found, as e.g. AWI obtained in the race and lactate.

In conclusion, the results suggest that the combination of the suggested physiological post mortem measures may provide information on fatigue (measured by lactate), damages (measured by creatine kinase), and dehydration (measured albumin/total protein). Thus, these measures are suggested as candidates for a future on-line monitoring of animal welfare on commercial abattoirs to document the level of welfare.

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